Topic	BBNC's 2012 Comments and Technical Submissions	Revised Bristol Bay Watershed Assessment	BBNC's Response to the Revised Bristol Bay Watershed Assessment
Estimating Habitat Loss	**Mine Footprint**: "The Draft Assessment underestimates the amount of habitat that would be lost under the hypothetical mine scenario. It does this in part by excluding certain areas from the mine footprint and, consequently, from the calculation of habitat acres lost to the mine footprint." (BBNC Part I Comments, at2) BBNC submitted technical comments by Thomas Yocom, explaining that EPA underestimated the 25-year mine scenario tailings storage facility footprint by 1,000 acres when it used hypothetical footprints taken directly from the Wardrop Report, thereby underestimating direct and indirect impacts to habitat. (BBNC Comments Part I, Attch. A, at 2-3)	The Revised Assessment uses the same assumptions and Wardrop Report data to calculate habitat acres that would be lost to the mine footprint. (Revised Assessment, at ES-10) However, the 25-year mine scenario footprint was revised slightly upward between the Draft and Revised Assessments – from a 14.9-km^2 tailings impoundment in the Draft Assessment to a 15.8-km^2 tailings impoundment in the Revised Assessment. (Draft Assessment, at ES-11 and Revised Assessment, at ES-11)	BBNC appreciates that EPA has revised its calculation of the 25-year mine scenario tailings storage facility footprint to accurately account for the size of a facility. BBNC would like to point out that EPA's calculations are still based on conservative assumptions and data found in the Wardrop Report.
	Use of Maps and Datasets: "[T]he Draft Assessment bases its estimate of stream losses on the Alaska National Hydrography Dataset (ANHD), which uses a coarse scale and therefore underestimates the reach and extent of streams in the vicinity [and] bases its estimate of wetland losses on National Wetlands Inventory (NWI) maps, even though Pebble Limited Partnership (PLP) delineated substantially more wetland and aquatic areas within its 'mine mapping area' than are shown in NWI maps of the same areas. As a result of this underestimation of habitat losses, the risks associated with such habitat loss are understated." (BBNC Part I Comments, at2)	EPA's Revised Assessment continues to use National Wetland Inventory maps to calculate wetlands impacts. EPA's Revised Assessment also continues to use the ANHD data to estimate the reach and extent of streams in the mine footprint vicinity that will be eliminated, blocked, or altered in flow. (Revised Assessment, at 7-21)	Use of these maps and datasets leads to a conservative overall quantification of jurisdictional wetlands acreage and stream reaches likely to be lost or negatively impacted under each of the Revised Assessment mining scenarios.

Topic	BBNC's 2012 Comments and Technical Submissions	Revised Bristol Bay Watershed Assessment	BBNC's Response to the Revised Bristol Bay Watershed Assessment
Estimating Habitat Loss (cont.)	**Mining Scenarios as a means of Estimating Habitat Loss and Mine Footprint**: "The Draft Assessment is [. . .] based on a reasonable hypothetical scenario. . . . EPA does not need to wait to see the details of any specific mine Section 404 permit application to determine whether unacceptable impacts will result from large-scale hardrock mining operations." (BBNC Comments Part II, at 12) "The hypothetical mine plan examined by EPA in the Draft Assessment, moreover, is drawn from preliminary plans for the Pebble Project as described by Northern Dynasty Minerals" in its State water rights applications and in the 2011 Wardrop Report." (BBNC Comments Part II, at 12)	EPA revised the Watershed Assessment to include a substantially smaller Pebble Mine scenario consisting of 0.25 billion tons of ore.	Although this mining scenario is substantially smaller than the 2.0 billion tons and 6.5 billion tons Pebble Mine scenarios included in the original Draft Watershed Assessment, the 0.25 scenario is still quite large with a total surface area impact of 5.88 square kilometers. Inclusion of the 0.25 billion ton scenario analysis—a Pebble mining scenario so small it would be uneconomical to develop in such a remote area—allows EPA to include very conservative assessment of negative impacts to the Bristol Bay watershed from mine development. Even under the very unlikely 0.25 scenario analysis, the Revised Assessment concludes that mining development would cause the unacceptable *direct loss* of 24 miles of streams, 5 miles of known spawning and rearing habitats for salmonids, and 1,200 acres of wetlands. (Revised Assessment, at ES-14)

Topic	BBNC's 2012 Comments and Technical Submissions	Revised Bristol Bay Watershed Assessment	BBNC's Response to the Revised Bristol Bay Watershed Assessment
Compensatory Mitigation	**Assessing the Risks to Offsetting Habitat Losses with Compensatory Mitigation**: "The Draft Assessment also does not adequately assess the challenges (risks) of mitigating these stream and wetland losses." (BBNC Part I Comments, at2)	The Revised Assessment now includes Appendix J, describing the potential of compensatory mitigation in the Bristol Bay region to offset habitat losses from large-scale metallic mines.	BBNC agrees with EPA's improved analysis of risks and uses of compensatory mitigation described in Appendix J. Indeed, Appendix J supports the conclusion that the mine scenarios (and the Pebble Mine as proposed) would not qualify for a Section 404 permit because of the lack of sufficient appropriate and practicable compensatory mitigation measures to offset the type and magnitude of aquatic resource losses.
	Site-Specific Mitigation: "Whereas Appendix I discusses mitigation practices and descriptions of mining industry standard practices, this 24-page report offers no specifics about the Bristol Bay watershed or mitigation practices therein" and "falls short of assessing the likelihood that a mine would be constructed that could adequately offset habitat losses." (BBNC Part I Comments, Attch. A, at 1-2)	In the Revised Assessment, EPA added Appendix J to assess compensatory mitigation	The discussion of compensatory mitigation in Appendix J of the Revised Assessment represents a significant improvement over the general discussion of mitigation that was included as Appendix I of the initial Draft BBWA.
	BBNC's Recommendation: "We recommend that EPA address in the Final Assessment the risks/probabilities that such losses could be adequately offset through compensatory mitigation measures. This discussion should include examples of large hardrock mining operations that have excavated and/or filled large areas of fisheries habitat and wetlands where those direct impacts have been either benign or offset by compensatory mitigation measures."(BBNC Part I Comments, at 2)	In the Revised Assessment, EPA added Appendix J to assess compensatory mitigation.	Appendix J represents a significant improvement over the general discussion of mitigation included in Appendix I of the Draft Assessment. The analysis in Appendix J provides ample support for the conclusion that there are no appropriate and practicable compensatory mitigation measures that would adequately offset the specific aquatic resource losses that would result from development of either the Pebble Mine or the BBWA mine scenarios

Topic	BBNC's 2012 Comments and Technical Submissions	Revised Bristol Bay Watershed Assessment	BBNC's Response to the Revised Bristol Bay Watershed Assessment
Wastewater Treatment	**Wastewater Treatment and the 'No Failure' Scenario**: "The Draft Assessment does not squarely address the challenges of constructing and operating a modern day mine that could possibly meet the 'no failure' scenario with respect to wastewater treatment." BBNC submitted detailed technical comments by William M. Riley, detailing various shortcomings with EPA's "No Failure" scenario as a means of assessing impacts with respect to wastewater treatment and reclamation. (BBNC Comments Part I, Attch. D)	The Revised Assessment now focuses on the day-to-day routine impacts of toxic leachate from wastewater containment facilities and nonpoint runoff sources. (Revised Assessment, at ES-15)	The Revised Assessment adopts a more realistic discussion of waste rock leachate through a routine operations scenario rather than the unrealistic "no failure" scenario utilized in the Draft Assessment. BBNC welcomes this improved analysis of the day-to-day routine impacts of large-scale metallic mining on water quality and the resulting direct negative impacts on downstream salmonids. The Revised Assessment properly concludes that long-term, non-catastrophic wastewater capture attempts utilizing even the best mining technology cannot avoid negative impacts to aquatic habitat.
	Wastewater Treatment and Seasonal Fluctuations: "[T]he water balance significantly underestimates the volume of contaminated wastewater that would require treatment during operation and post-closure, as it does not account for extreme events such as peak storm runoff… [T]he Draft Assessment does not adequately address the fact that the enormous amounts of wastewater could be discharged only during the five months of the year when receiving waters are not frozen, greatly increasing the magnitude of the water management challenge." (BBNC Part I Comments, at 3-4)	The Revised Assessment continues to include more limited assumptions of seasonal flow variations, such as assessing how large snowmelt flows would impact wastewater treatment facilities and increase nonpoint source runoff. (Revised Assessment, at 8-4, routine operation wastewater volume calculated on a yearly, non-seasonal basis)	Despite these conservative assumptions used to calculate required wastewater capture efficiency, the Revised Assessment properly concludes that even long-term, non-catastrophic wastewater capture utilizing the best mining technology cannot avoid negative impacts to aquatic habitat.

Topic	BBNC's 2012 Comments and Technical Submissions	Revised Bristol Bay Watershed Assessment	BBNC's Response to the Revised Bristol Bay Watershed Assessment
Wastewater Treatment (cont.)	**Tailings Leachate**: "The Draft Assessment does not address the porous nature of the surficial deposits and fractured bedrock in the project area as well as other information that places in serious doubt the ability of a conventional, unlined tailings impoundment to capture toxic tailings leachate before it enters the local groundwater system." (BBNC Part I Comments, at 3)	The Revised Assessment better utilizes advanced modeling to detail wastewater capture, treatment, and leachate potential under routine operation scenarios. By utilizing modeling to assess these parameters, the Revised Assessment adopts a more realistic discussion of waste rock leachate through a routine operations scenario rather than the unrealistic "no failure" scenario utilized in the Draft Assessment.	BBNC welcomes EPA's approach to assessing tailings leachate contamination and points out that, as EPA's revised analysis shows, even routine large-scale mining operations with wastewater collection and treatment cannot operate without degrading water quality and causing direct negative impacts on salmonids downstream.
	Water Quality Criteria: "In addition to the unprecedented quantity of contaminated water that would require treatment (over 130 million gallons per day), State of Alaska water quality criteria (WQC) would have to be met end-of-pipe without the benefit of dilution (all other Alaska hardrock mines rely on dilution to meet WQC)." (BBNC Part I Comments, at 3-4)	The Revised Assessment contains considerable more attention to leachate contamination and the impacts of this on water quality. Utilizing modeling, EPA concludes that "greater than 99% capture efficiency would be required to prevent exceedance of the copper criteria for the South Fork Koktuli River under the Pebble 6.5 scenario." (Revised Assessment, at ES-15)	BBNC thanks the EPA for this additional analysis and would like to point out the Revised Assessment's conclusion that even long-term, non-catastrophic wastewater capture utilizing the best mining technology cannot avoid negative impacts to aquatic habitat.
	BBNC Recommendation: "We recommend that in the Final Assessment EPA at a minimum acknowledge that the result of this approach is an understatement of both the water management challenge and the potential for water management failures associated with its hypothetical mine scenario." (BBNC Part I Comments, at 4)	The Revised Assessment largely removes the failure/no failure dichotomy and adopts an approach to modeling wastewater contamination that better shows the challenges of water management and the potential for non-catastrophic failures.	BBNC thanks the EPA for its updated approach to its analysis of wastewater treatment and management. This strengthens the conclusion that even the best wastewater capture technology will not prevent exceeding the copper criteria for the South Fork Koktuli River under the Pebble 6.5 scenario.

Topic	BBNC's 2012 Comments and Technical Submissions	Revised Bristol Bay Watershed Assessment	BBNC's Response to the Revised Bristol Bay Watershed Assessment
	Long-Term "No Failure" Scenario: "The Draft Assessment does not squarely address the challenges of constructing and operating a modern day mine that could actually meet the 'no failure' scenario with respect to reclamation. Post-closure, aquatic habitats would have to be recreated on an unprecedented scale and waters within the reclamation area would have to meet water quality standards." (BBNC Part I Comments, at 4)	The Revised Assessment largely removes the failure/no failure dichotomy.	BBNC would like to point out that the Revised Assessment's treatment of uncertainties associated with perpetual treatment admits "[t]he response of the current technology in the construction of tailings dams is untested and unknown in the face of centuries of extreme events . . . ." BBNC agrees with EPA's characterization that perpetual treatment of large-scale metallic hardrock mining is untested and not worth the risk.
Post-Closure Reclamation	**BBNC Recommendation**: "The Draft Assessment leaves unanswered a number of questions about the feasibility of reclamation, including whether there will be adequate cover material and topsoil, and whether any mining project in a sub-arctic region has ever successfully achieved reclamation of this nature on so large a scale. We recommend that EPA address these questions in the Final Assessment." (BBNC Part I Comments, at 4)	These questions remain unaddressed in the Revised Assessment. Appendix I is the only section of the Revised Assessment that substantially discusses post-closure reclamation and it does not address these concerns. Indeed, the Revised Assessment notes that it "assume[s] that the site would be reclaimed according to statutory requirements, but it is outside the scope of the assessment to evaluate a specific post-closure plan." (Revised Assessment, at 4-8)	BBNC notes that the Revised Assessment devotes little attention to the feasibility and specifics of post-closure reclamation, which would be extremely difficult for a mine like the proposed Pebble mine. The assessment thus remains conservative in this regard as well.

Topic	BBNC's 2012 Comments and Technical Submissions	Revised Bristol Bay Watershed Assessment	BBNC's Response to the Revised Bristol Bay Watershed Assessment
Cumulative and Watershed-Scale Effects of Multiple Mines	**Underestimation of Cumulative Habitat Loss**: "The Draft Assessment appears to underestimate habitat losses in the cumulative case, just as in its risk assessment proper." (BBNC Part I Comments, at 4)	The Revised Assessment contains the same set of assumptions to assess habitat losses. (See above discussion of Estimating Habitat Loss) Moreover, the Revised Assessment contains an extremely conservative 0.25 billion ton mining scenario for use in its cumulative analysis.	BBNC notes that EPA's revised analysis of cumulative habitat loss underestimates the direct aquatic and terrestrial habitat losses, and is thus conservative in this regard as well.
	Joint Facility Use: "the Draft Assessment makes a number of assumptions about joint use of facilities by multiple mining operations that may not be valid and that may result in an understatement of the risks of multiple mine development." (BBNC Part I Comments, at 4)	The Revised Assessment continues to use the same assumptions about the joint use of facilities by multiple mining operations. (Revised Assessment, at 13-9)	BBNC notes that EPA's use of such assumptions makes its cumulative impacts analysis conservative.
	BBNC Recommendation: "EPA should at a minimum acknowledge" the limiting assessments of joint facility use and underestimation of habitat impacts. (BBNC Part I Comments, at 4)	EPA acknowledges limitations of its cumulative footprint analysis, stating that "[t]he actual infrastructure needed to operate any large-scale mine would be significantly more extensive [...] and would result in a large cumulative mine footprint." (Revised Assessment at 6-3)	BBNC thanks EPA for acknowledging its use of conservative cumulative impact assumptions and would like to point out that EPA's estimations of cumulative impacts on habitat from multiple mines remain conservative quantifications.

Topic	BBNC's 2012 Comments and Technical Submissions	Revised Bristol Bay Watershed Assessment	BBNC's Response to the Revised Bristol Bay Watershed Assessment
Fisheries and Aquatic Habitat	**Overall**: "The fisheries and aquatic habitat information in the Draft Assessment is very informative and well-written, and thus understandable to a wide variety of stakeholders." (BBNC Part I Comments, at 2)	EPA re-organized the chapters and appendixes in a manner that makes the Revised Assessment even more understandable and accessible than the previous draft.	The Revised Assessment is very informative, organized, and well-written. BBNC thanks the EPA for developing a document that will be relied on by agency decisionmakers, stakeholders, and the general public as a valuable information resource and as a guide in future federal, State, and local decision-making processes affecting the waters, fishery resources, and Native cultures of Bristol Bay.
	BBNC Recommendation: "EPA should add a greater explanation of the key terms 'quality,' 'diversity,' and 'portfolio effect,' as they are used with respect to fish." (BBNC Part I Comments, at 3)	The Assessment was revised considerably to include more information about the biological complexity of salmon stocks and the portfolio effect. (Revised Assessment, sections 5.2.4 and 13.4.1)	BBNC welcomes these revisions and EPA's acknowledgment that the losses of streams and wetlands would affect genetically unique populations of salmon, undermining the stability of the overall Bristol Bay fishery that depends on the genetic diversity of individual populations.
	BBNC Recommendation: "Appendix F could be expanded to include more of the considerable available information about the importance of Bristol Bay as a rearing area for several species of commercially important fishes." (BBNC Part I Comments, at 3)	Appendix F was expanded slightly to consider more discussion of salmon contribution to trophic levels and salmon range and distribution. Moreover, the Revised Assessment itself was also updated to include considerable more attention to the upper Bristol Bay watershed reaches as rearing habitat for several species of commercially important and subsistence fishes. (Revised Assessment, at 3-18 to 3-28)	BBNC welcomes this expansion of Appendix F and the Assessment itself, as these now contain more information about the upper reaches of Nushagak and Kvichak River systems as important salmon rearing habitat.

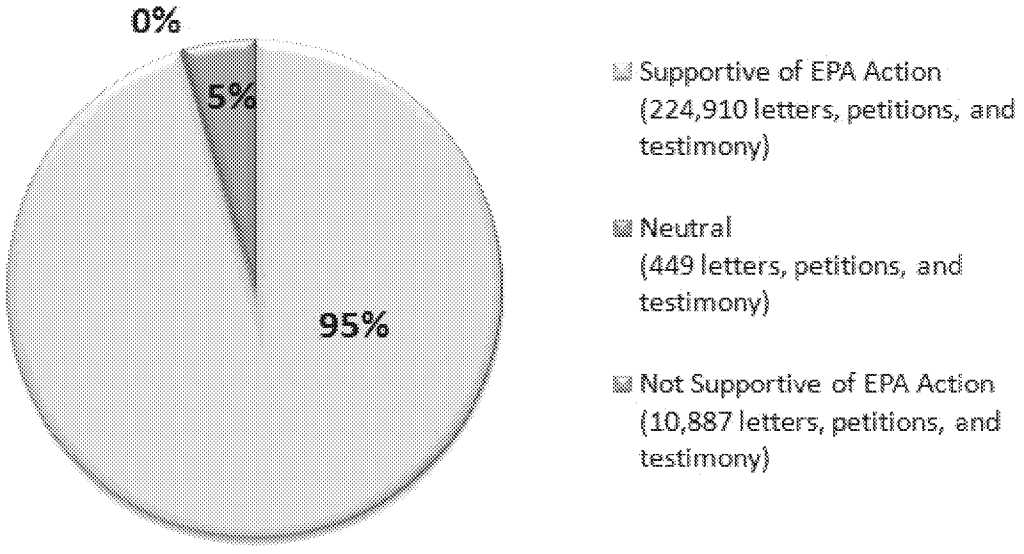
Topic	BBNC's 2012 Comments and Technical Submissions	Revised Bristol Bay Watershed Assessment	BBNC's Response to the Revised Bristol Bay Watershed Assessment
Subsistence and Socioeconomic Impacts	**Socio-Economic Impacts to Local Communities**: The Draft Assessment "does not adequately discuss the very important socioeconomic impacts to local communities that would likely result from the potential environmental impacts of the development of the hypothetical mine scenario." (BBNC Part I Comments, at 5)	EPA notes that socioeconomic impacts to local communities is only a secondary and indirect effects endpoint for consideration in the assessment. (Revised Assessment at 5-1)	BBNC notes that the Revised Assessment does not analyze the multiple inevitable impacts to Alaska Native cultures and ways of life if large-scale hardrock mining development proceeds in Bristol Bay. BBNC recognizes that EPA has limited the scope of its assessment to "fish-mediated" impacts on Alaska Natives, and notes that this limited scope makes the assessment very conservative in nature. BBNC is pleased that the Revised Assessment expanded the "fish-mediated risk" analysis into a full and separate chapter.
	BBNC Recommendation: "There is substantial literature documenting the adverse impacts of mining and energy development on small indigenous communities, such as increased inflation, overwhelming demands on existing services, and increases in social problems like domestic violence. The Assessment would benefit from greater attention to this literature and a more thorough and prominent discussion of these threats." (BBNC Part I Comments, at 5) BBNC submitted detailed technical comments from Don Callaway, containing a thorough evaluation of the socioeconomic environment near the Pebble Deposit. (BBNC Part I Comments, Attach. E)	EPA's Revised Assessment includes no references to the socioeconomic evaluation provided by Don Callaway and submitted as part of BBNC's 2012 comments.	BBNC notes that the Revised Assessment is very conservative in assessing subsistence and socioeconomic impacts. Indeed, the Revised Assessment merely focuses on subsistence foods and lifestyle indirectly as an endpoint for evaluating the impact of salmon loss, rather than including a separate endpoint for analysis of the impacts on local communities from the mine itself.

Topic	BBNC's 2012 Comments and Technical Submissions	Revised Bristol Bay Watershed Assessment	BBNC's Response to the Revised Bristol Bay Watershed Assessment
	Salmon as a Keystone Species: "More attention should be focused on the impacts that loss of or damage to the salmon resource would have on these other wildlife resources – either as a food source or, more generally, as a source of nutrients for their habitat." (BBNC Part I Comments, at 5)	The Revised Assessment devotes more attention to the impacts of salmon decline on other important species. (Revised Assessment, at Ch. 12)	BBNC welcomes these changes to the assessment, as they further exemplify the importance of salmon to the entire Bristol Bay ecosystem.
Wildlife and Subsistence Impacts	**Assessing Mine Impacts on Wildlife**: "the Draft Assessment does not address the potential for noise pollution or fugitive dust resulting from the mining infrastructure and what effects this might have on the behavior of key subsistence species like caribou, moose, and migratory bird and waterfowl. The Draft Assessment also does not examine the effects the transportation corridor might have on the movement and behavior of these species." (BBNC Part I Comments, at 5)	The Revised Assessment devotes more attention to important subsistence resources beyond salmon, including non-salmonid fishes (rainbow trout and char) and other wildlife (bear, moose, caribou, waterfowl). (Revised Assessment, at 5-32 and 12-8) The Revised Assessment also recognizes the importance of these subsistence resources—acknowledging the importance of all salmonid species, various non-salmon fishes, caribou, moose, waterfowl, and berries. (Revised Assessment at Ch. 5)	BBNC is pleased to see that the Revised Assessment contains a more comprehensive analysis of important subsistence resources in the Bristol Bay region and the impacts of varying mine proposal sizes on these subsistence resources.

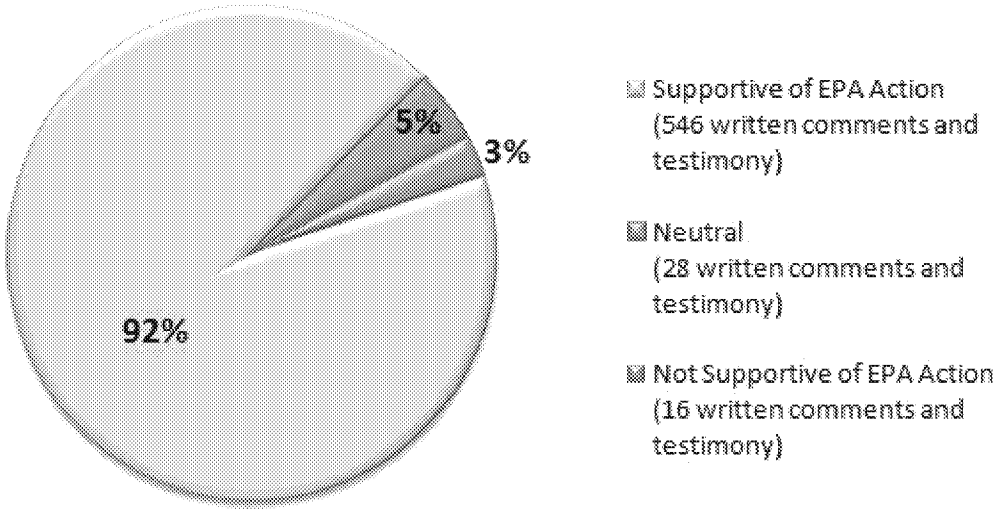
Appendix B

Overwhelming Public Support for EPA Action to Protect Bristol Bay[i]

All Public Comments & Public Hearing Testimony on the EPA Draft Bristol Bay Watershed Assessment



Bristol Bay Region Public Comments and Testimony



For additional information: Daniel Cheyette, Bristol Bay Native Corporation, (907) 278-3602

[i] Numbers compiled from all individual written public comments, mass mailings, and public hearing testimony found in the EPA Bristol Bay Watershed Assessment docket at www.regulations.gov. Charts exclude late comments. Bristol Bay regional chart excludes all comments submitted via national organizations. "Neutral" refers to comments that do not take a position on EPA involvement or 404c action, i.e. some science reports and comments, neutral requests for extension of time, etc.

Appendix C

The Economic Importance of the Bristol Bay Salmon Industry

prepared for the

Bristol Bay Regional Seafood Development Association

by

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Appendix C

THE ECONOMIC IMPORTANCE OF THE BRISTOL BAY SALMON INDUSTRY

EXECUTIVE SUMMARY

By any measure, the Bristol Bay sockeye salmon fishery is very large and valuable. It is the world's most valuable wild salmon fishery, and typically supplies almost half of the world's wild sockeye salmon. In 2010, harvesting, processing, and retailing Bristol Bay salmon and the multiplier effects of these activities **created $1.5 billion** in output or sales value across the United States.

In 2010, Bristol Bay salmon fishermen harvested 29 million sockeye salmon worth $165 million in direct harvest value alone. That represented 31% of the total Alaska salmon harvest value, and was greater than the total value of fish harvests in 41 states. Salmon processing in Bristol Bay increased the value by $225 million, for a total first wholesale value after processing of $390 million. The total value of Bristol Bay salmon product exports in 2010 was about $250 million, or about 6% of the total value of all U.S. seafood exports.

In 2010, the Bristol Bay sockeye salmon fishery supported 12,000 fishing and processing jobs during the summer salmon fishing season. Measuring these as year-round jobs, and adding jobs created in other industries, the Bristol Bay salmon fishery created the equivalent of almost 10,000 year-round American jobs across the country, and brought Americans $500 million in income. For every dollar of direct output value created in Bristol Bay fishing and processing, more than two additional dollars of output value are created in other industries, as payments from the Bristol Bay fishery ripple through the economy. These payments create almost three jobs for every direct job in Bristol Bay fishing and processing.

United States domestic consumption of Bristol Bay frozen sockeye salmon products has been growing over time as a result of sustained and effective marketing by the industry, new product development and other factors. This growth is likely to continue over time, which will result in even greater output value figures for the industry's economic impacts across the U.S.

The economic importance of the Bristol Bay salmon industry extends far beyond Alaska, particularly to the West Coast states of Washington, Oregon and California.

Bristol Bay fishing boats

- About one-third of Bristol Bay fishermen and two-thirds of Bristol Bay processing workers live in West Coast states.
- Almost all major Bristol Bay processing companies are based in Seattle.
- Most of the supplies and services used in fishing and processing are purchased in Washington state.
- Significant secondary processing of Bristol Bay salmon products occurs in Washington and Oregon.

The economic importance of the Bristol Bay salmon industry goes well beyond the value, jobs, and income created by the fishing and processing which happens in Bristol Bay. More value, jobs and income are created in *downstream industries* as

Bristol Bay salmon are shipped to other states, undergo further processing, and are sold in stores and restaurants across the United States. Still more jobs, income and value are created in other industries through *multiplier impacts* as Bristol Bay fishermen and processors and downstream industries purchase supplies and services, and as their employees spend their income.

Economic Impacts of the Bristol Bay Salmon Industry in 2010

Annual average employment: 9,800 jobs	Output value: $1.5 billion	Income: $500 million
Fishing & processing in Bristol Bay		
12,000 seasonal jobs (=2,000 annual jobs)	$390 million	$140 million
Shipping, secondary processing & retailing after Bristol Bay		
1,000 jobs	$110 million	$40 million
Multiplier impacts in other industries		
6,800 jobs	$970 million	$320 million

Overview of the Bristol Bay Salmon Industry

Bristol Bay is located in southwestern Alaska. Each year tens of millions of sockeye salmon return to spawn in the major river systems which flow into Bristol Bay. The large lakes of the Bristol Bay region provide habitat for juvenile sockeye salmon during their first year of life.

A Bristol Bay salmon fisherman

For well over a century, Bristol Bay salmon have supported a major salmon fishing and processing industry. Most of the harvest occurs between mid-June and mid-July. At the peak of the fishing season, millions of salmon may be harvested in a single day.

Only holders of limited entry permits (issued by Alaska's state government) and their crew are allowed to fish in Bristol Bay. There are permits for two kinds of fishing gear: drift gillnets (operated from fishing boats) and set gillnets (operated from shore). There are approximately 1,860 drift gillnet permits and approximately 1,000 set net permits. Drift gillnet permits average much higher catches and account for most of the total catch. About one-third of the permit holders are from West Coast states.

Bristol Bay Salmon Industry Permit Holders, by State of Residence, 2010

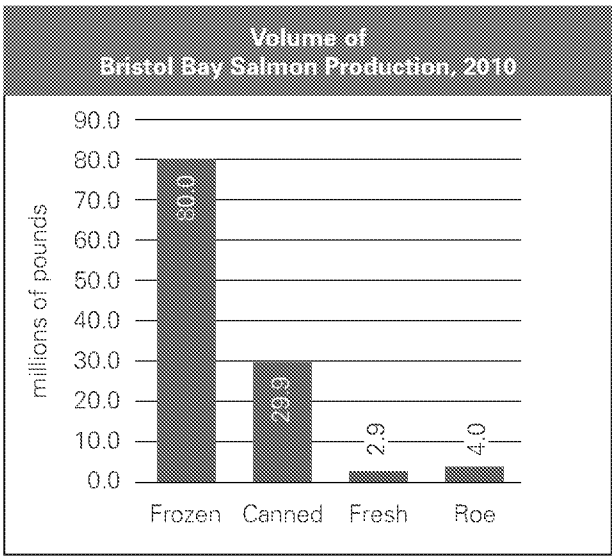
Permit Type	Alaska	Washington	Oregon	California	Other States & Countries	Total
Drift Gillnet	845	642	98	109	156	1,850
Set Gillnet	629	127	38	34	99	927
Total	1,474	769	136	143	255	2,777

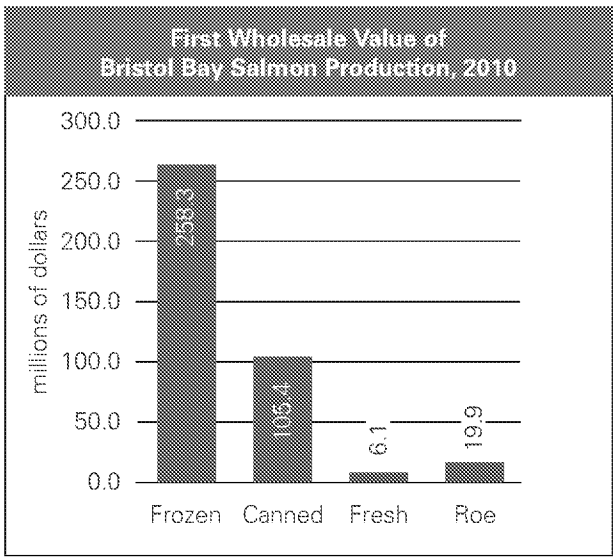
For each permit holder, who is usually a captain, there are typically two to three additional crew members. About 7,000 fishermen fished in Bristol Bay in 2010.

The Bristol Bay salmon harvest is processed by about 10 large processing companies and 20 smaller companies employing about 5,000 processing workers at the peak of the season in both land-based and floating processing operations. Most of the workers are from other states and live in bunkhouse facilities at the processing plants.

Bristol Bay salmon are processed into four major primary products: frozen salmon, canned salmon, fresh salmon, and salmon roe. Frozen salmon includes both headed and gutted (H&G) salmon as well as salmon fillets.

Frozen and canned salmon account for most of the volume and value of Bristol Bay salmon production.

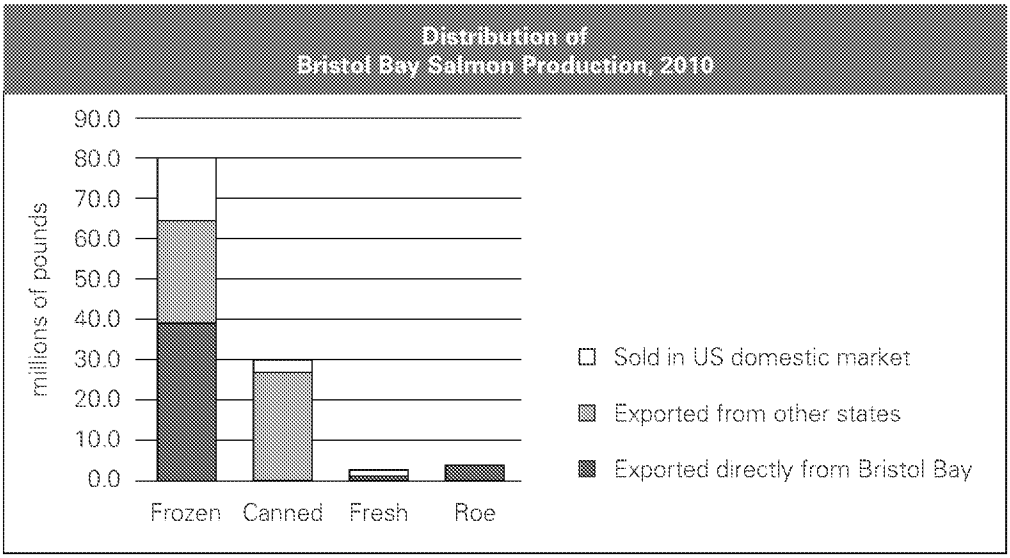




About half of Bristol Bay frozen salmon is exported directly from Bristol Bay, primarily to Japan and China. Most of the remaining frozen salmon is shipped to Washington state where much of it is repackaged and/or reprocessed into secondary products such as fillets, portions and smoked salmon. Some of these products are exported while the rest are sold in the US domestic market.

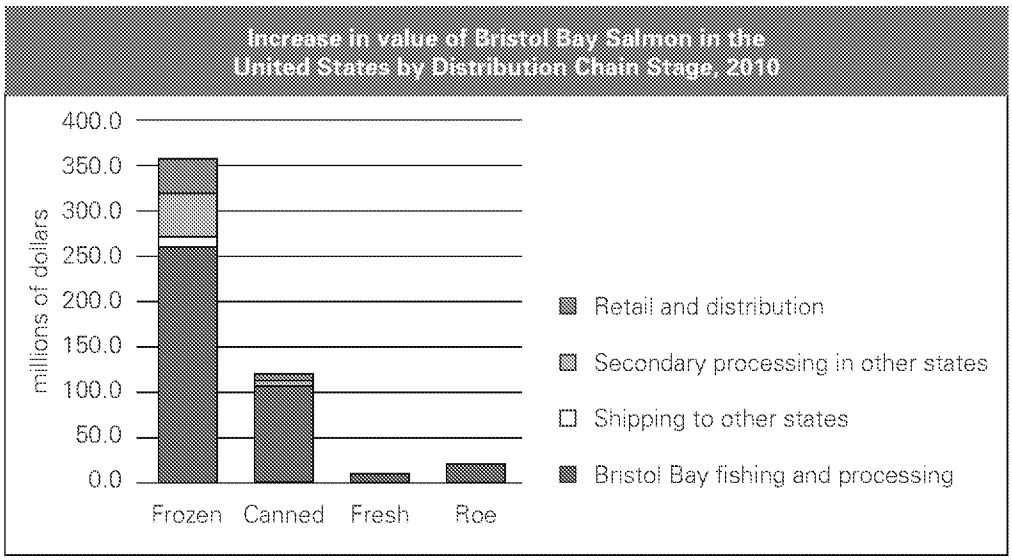
Bristol Bay canned salmon is shipped to warehouses in Washington and Oregon where it is stored, labeled, and sold by processors over the course of the year, mostly to the United Kingdom and other export markets.

The total value of Bristol Bay salmon product exports in 2010 was about $252 million, or about **6% of the total value of all U.S. seafood exports.**



The value of Bristol Bay salmon increases at each stage in the distribution chain. Because a large share is exported, most of the increase in value in the United States occurs in Bristol Bay fishing and processing. About one-fifth of the total increase in value occurs in later stages of the distribution chain.

Containers for shipping Bristol Bay salmon products



Economic Impacts of the Bristol Bay Salmon Industry

Economic impacts of the Bristol Bay salmon industry are the jobs, income and output value created by the fishery—or the jobs, income and output value that would not exist if the industry did not exist. Economic impacts include:

» *Direct economic impacts:* Jobs, income and output value in businesses directly involved in harvesting, processing, and retailing Bristol Bay salmon.

» *Multiplier economic impacts:* Jobs, income and output value created in other industries as Bristol Bay fishermen, processors and downstream industries purchase supplies and services, and as their employees spend their income.

We estimated both direct and indirect economic impacts for three stages of the distribution or value chain for Bristol Bay salmon in the United States:

» Fishing and primary processing in Bristol Bay

» Shipping to other states and secondary processing

» Distribution and retailing (nationwide transportation, wholesaling and retailing of Bristol Bay salmon products in stores and restaurants throughout the United States)[1]

[1] The economic effects of distribution and retailing of Bristol Bay salmon are technically economic contributions rather than economic impacts, because if Bristol Bay salmon did not exist stores would sell other products instead, which would still create jobs, income and output value. Because no data are available for Bristol Bay salmon retail volumes and prices, our estimates of economic contributions for this stage are based on the simple assumption that distribution and retailing increases the value of Bristol Bay salmon products by an average of 50%.

Appendix C

We estimated economic impacts for the United States as well as for Alaska, Washington, Oregon and California in 2010. To estimate economic impacts, we used IMPLAN input-output modeling software which tracks the ripple effects of payments between industries at both the national level as well as within individual states.

Our economic impact estimates do not account for the fact that Bristol Bay salmon fishing and processing helps to cover a significant share of the fixed costs of many Alaska and Pacific Northwest fishermen and processors, or for the economic benefits of Bristol Bay salmon exports in helping to offset the large United States seafood trade deficit. Thus our estimates of the economic importance of the Bristol Bay seafood industry are conservative.

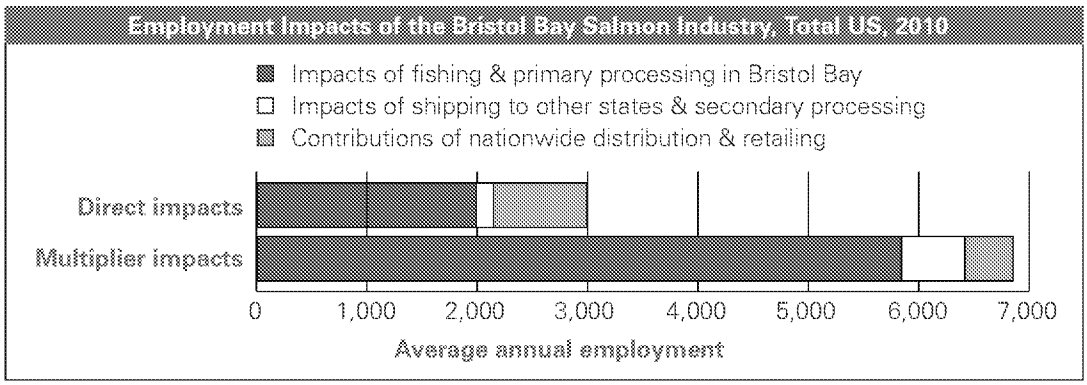
In 2010, almost 12,000 people worked in the Bristol Bay salmon industry during the fishing season, which occurs primarily in June and July. Of these, about 4,400 were Alaska residents, while most of the others were residents of West Coast states.

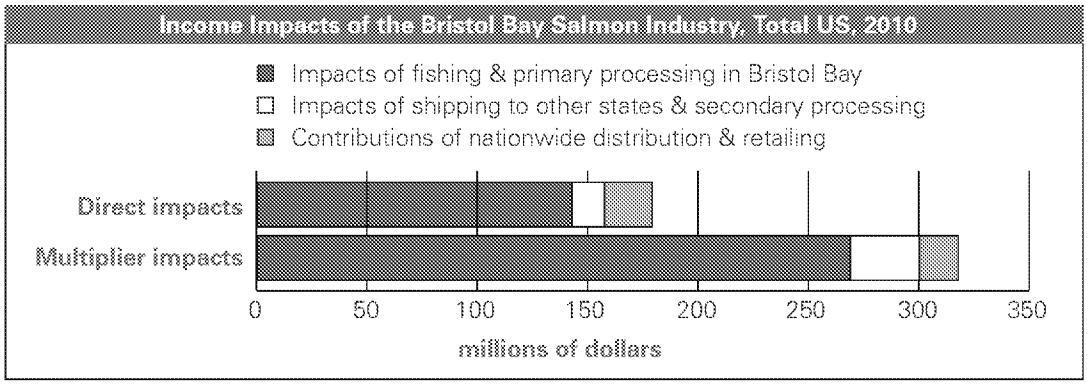
To compare Bristol Bay seasonal jobs lasting about two months with other year-round employment impacts, we converted them to annual average employment by dividing seasonal employment by six. Expressed as annual average employment, in 2010, almost 10,000 American jobs were created in harvesting, processing, and retailing Bristol Bay salmon and through the multiplier effects of these activities.

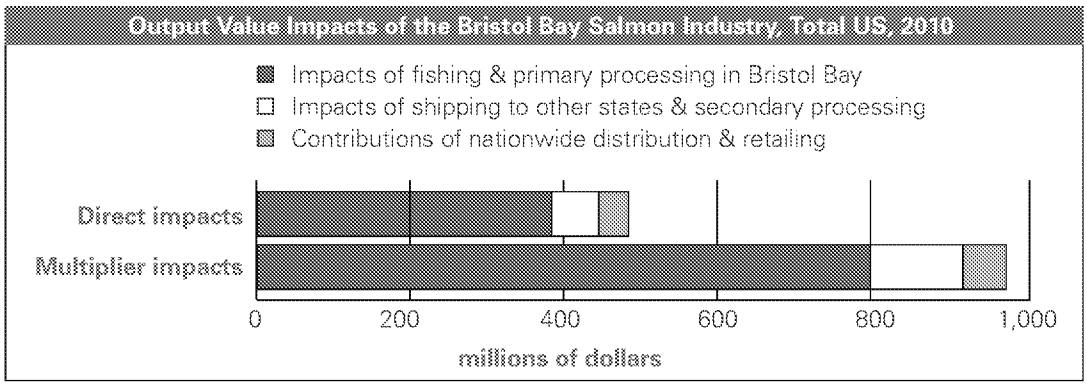
In 2010, Americans earned $500 million from harvesting, processing, and retailing Bristol Bay salmon and the multiplier effects of these activities.

Seasonal Jobs in the Bristol Bay Salmon Industry, by State of Residence, 2010

	Total US	Alaska	Washington	Oregon	California	Other States
Fishing	7,035	3,734	1,948	362	345	646
Processing	4,886	635	1,279	1,781	208	983
Total	11,921	4,369	3,227	2,143	553	1,629







In 2010, $1.5 billion in output value was created in the United States in harvesting, processing, and retailing Bristol Bay salmon and the multiplier effects of these activities.

Appendix C

The tables below provide additional details of our economic impact estimates. A large share of the impacts occur in West Coast states—reflecting the fact that about one-third of Bristol Bay fishermen and two-thirds of Bristol Bay processing workers live in West Coast states; almost all major Bristol Bay processing companies are based in Seattle; most of the supplies and services used in fishing and processing are purchased from Washington; and significant secondary processing of Bristol Bay salmon products occurs in Washington and Oregon.

Employment Impacts of the Bristol Bay Salmon Industry, 2010 (annual average employment)

Impact Driver		Total US	AK	WA	OR	CA	Other States
Fishing and primary processing in Bristol Bay	Direct impacts*	1,987	728	538	92	357	271
	Multiplier impacts	5,852	1,338	2,237	163	249	1,865
	Total impacts	7,839	2,066	2,775	255	606	2,137
Shipping to other states and secondary processing	Direct impacts	191		156	15		
	Multiplier impacts	563		229	24		
	Total impacts	754		385	39		
Total impacts		8,592		3,160	294		
Nationwide distribution and retailing**	Direct contributions	787	Note: Total US may exceed sum of estimates shown for individual states; see report for technical explanation. *Direct employment impacts of fishing and processing in Bristol Bay were calculated by dividing seasonal employment by 6. **Based on conservative assumption that distribution and retailing increases value by 50%.				
	Multiplier contributions	425					
	Total contributions	1,212					
Total impacts & contributions		9,804					

Income Impacts of the Bristol Bay Salmon Industry, 2010 (millions of dollars)

Impact Driver		Total US	AK	WA	OR	CA	Other States
Fishing and primary processing in Bristol Bay	Direct impacts	144	50	48	8	19	18
	Multiplier impacts	268	62	98	7	12	90
	Total impacts	412	112	146	15	31	108
Shipping to other states and secondary processing	Direct impacts	13		11	1		
	Multiplier impacts	30		12	1		
	Total impacts	43		23	2		
Total impacts		455		169	17		
Nationwide distribution and retailing*	Direct contributions	23	Note: Total US may exceed sum of estimates shown for individual states; see report for technical explanation. *Based on conservative assumption that distribution and retailing increases value by 50%.				
	Multiplier contributions	20					
	Total contributions	42					
Total impacts & contributions		497					

Appendix C

Output Value Impacts of the Bristol Bay Salmon Industry, 2010 (millions of dollars)							
Impact Driver		Total US	AK	WA	OR	CA	Other States
Fishing and primary processing in Bristol Bay	Direct impacts	390	127	198	13	19	32
	Multiplier impacts	801	161	288	19	37	297
	Total impacts	1,191	288	486	32	56	329
Shipping to other states and secondary processing in WA & OR	Direct impacts	68		56	4		
	Multiplier impacts	111		37	3		
	Total impacts	179		93	6		
Total impacts		1,370		580	38		
Nationwide distribution and retailing*	Direct contributions	46	Note: Total US may exceed sum of estimates shown for individual states; see report for technical explanation. Output value allocated among states based on the residency of fishing and processing workers and business locations. * Based on conservative assumption that distribution and retailing increases value by 50%.				
	Multiplier contributions	61					
	Total contributions	106					
Total impacts & contributions		1,476					

Conclusions

The Bristol Bay salmon fishery is the world's most valuable wild salmon fishery. It contributes well over $1 billion in value and about 10,000 jobs to the United States economy every year, across multiple industries and states. It has operated continuously for more than 120 years and can continue to provide significant and widespread economic benefits across multiple industries and states for the foreseeable future.

Appendix C

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I. INTRODUCTION

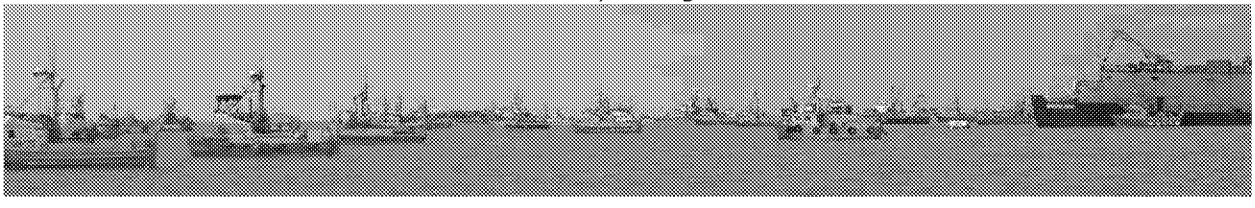
Alaska's Bristol Bay salmon fishery is the world's most valuable salmon fishery. The 2010 Bristol Bay salmon harvest had a value of $165 million. Processing increased the value by $225 million to a total first wholesale value of $390 million for the salmon products produced in Bristol Bay. The Bristol Bay salmon industry employed about 7,000 fishermen and about 4,900 processing workers during the intense June and July fishing season.

This study describes and quantifies the economic importance of the Bristol Bay salmon industry for the United States and for the four west coast states—Alaska, Washington, Oregon and California—which are home to most of the fishermen and processing workers as well as most of the processing companies and the businesses which supply the industry. We estimate "economic impact" measures of the annual average employment, income, and output value (sales value) which the Bristol Bay salmon industry created in 2010 in the United States and in these four states.

Chapter II of this report provides an overview of the Bristol Bay salmon industry. Chapter III describes our methodology for estimating economic impacts. Chapter IV discusses the *direct economic impacts* of Bristol Bay salmon fishing and processing: the employment, income and output value created in Bristol Bay in fishing and processing. Chapter V discusses the *multiplier economic impacts* of Bristol Bay salmon fishing and processing: the jobs, income and output value created in other industries through the ripple effects of Bristol Bay fishing and processing on the rest of the economy. Chapter VI discusses the *downstream economic effects* of the Bristol Bay salmon industry: the jobs, income and output value created in transportation, secondary processing, warehousing, distribution and retailing after salmon products leave Bristol Bay. Chapter VII summarizes major conclusions of the report.

Estimating economic impacts of the Bristol Bay salmon industry is a technically complex task which required developing numerous assumptions about the payments made by fishermen and processors and in downstream industries as inputs to national and state-level IMPLAN input-output models. To make the report accessible to non-technical readers, in the body of the report we focus on describing our findings. The appendixes provide full technical documentation of our analysis.

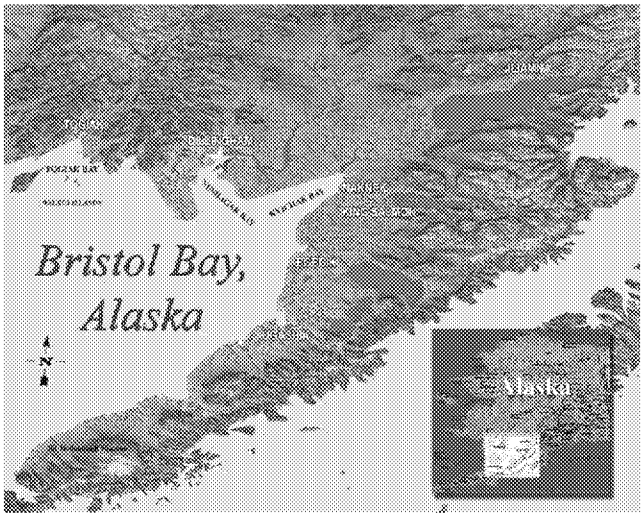
Bristol Bay fishing boats



A Bristol Bay fish processing plant

II. OVERVIEW OF THE BRISTOL BAY SALMON INDUSTRY

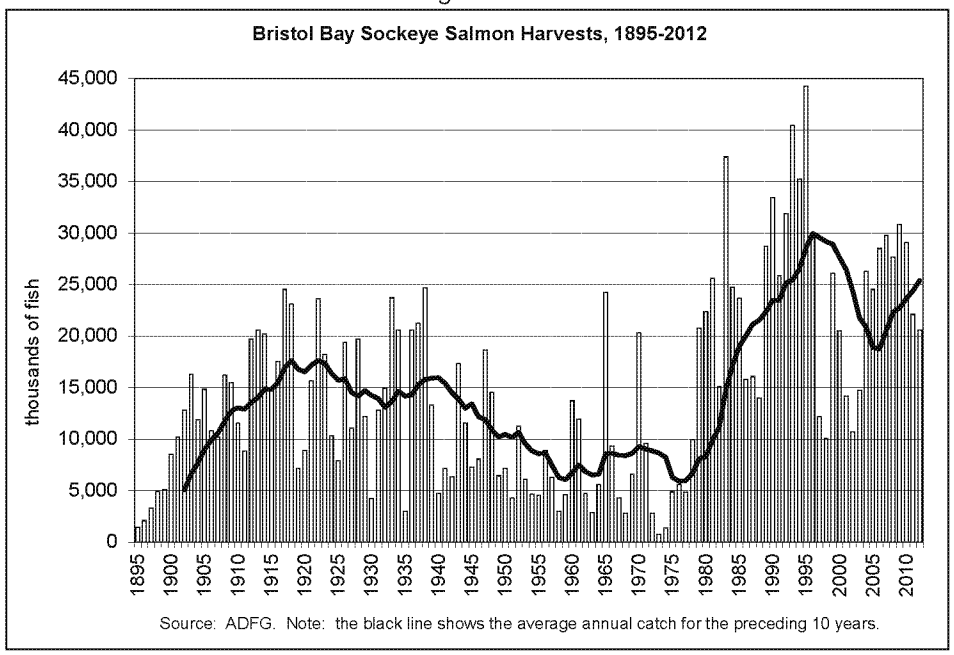
Bristol Bay is located in southwestern Alaska. Each year tens of millions of sockeye salmon return to spawn in the major river systems which flow into Bristol Bay. The large lakes of the Bristol Bay region provide habitat for juvenile sockeye salmon during their first year of life.



Source: Environmental Protection Agency

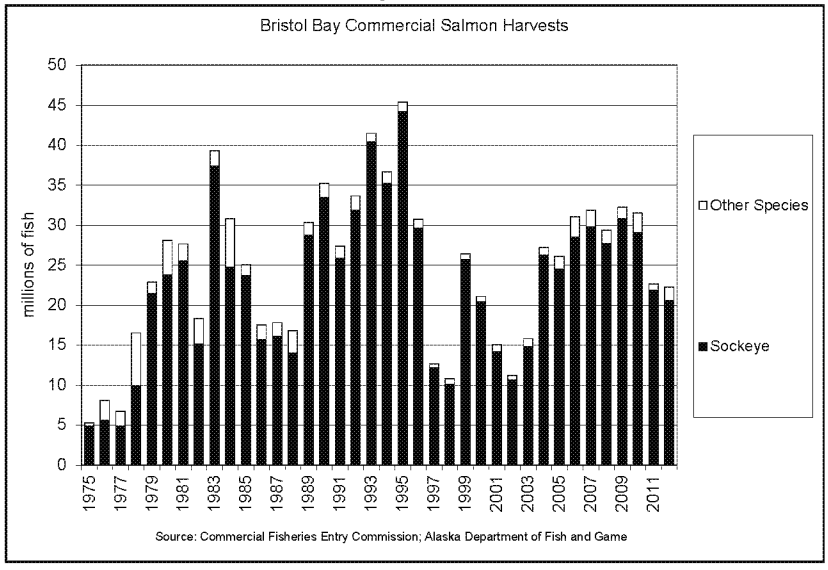
For well over a century, Bristol Bay salmon have supported a major salmon fishing and processing industry. During the 118 years between 1895 and 2012, Bristol Bay fishermen harvested more than 1.7 billion sockeye salmon, with an annual average harvest of 15 million sockeye salmon. Harvests have been particularly strong since 1980, with an annual average harvest of 24.6 million sockeye salmon during the period 1980-2012.

Figure II-1



Bristol Bay commercial salmon harvests are overwhelmingly sockeye salmon, although the other four species of Pacific salmon are also caught in Bristol Bay in much smaller numbers. Except where otherwise noted, references in this report to Bristol Bay salmon are specifically for Bristol Bay *sockeye* salmon.

Figure II-2



Bristol Bay salmon runs vary widely from year to year and over longer periods of time, due to variations in the freshwater and marine environments which affect salmon survival rates over their life-cycle. The Alaska Department of Fish and Game (ADF&G) manages the fishery to achieve "escapement" goals for the number of fish which "escape" the commercial fishery and enter the different Bristol Bay river systems to spawn, by opening and closing fishing in different districts multiple times over the season.

Bristol Bay fishermen fished from sailboats until the 1950s

Source: "Sailing for Salmon" exhibition of historic Bristol Bay photographs at Anchorage Museum, summer 2011 (http://www.anchoragemuseum.org)

Most of the Bristol Bay salmon harvest occurs between mid-June and mid-July. In early July, at the peak of the fishing season, millions of salmon may be harvested in a single day. During this time, Bristol Bay is a frenzy of activity, with many thousands of fishermen and fish processors working around the clock.

Bristol Bay Fishing

Bristol Bay salmon are harvested using gillnets. Gillnets hang in the water perpendicular to the direction in which returning salmon are swimming. The fish get their heads stuck in the nets and are "picked" from the net as it is pulled from the water.

There are two types of gillnet fishing operations in Bristol Bay: drift gillnet and set gillnet. Drift gillnet fishing is done from fishing boats, which are limited to 32 feet in length. Fishermen let the net out behind the boat, and after a period of time pull it back into the boat to pick the fish. In set gillnet fishing, one end of the net is attached to the shore, while the other is attached to an anchor in the water. Fishermen pick the fish from a skiff or from the beach at low tide.

Picking salmon on a Bristol Bay drift gillnet boat

A set-net fishing operation

Like all Alaska salmon fisheries, the Bristol Bay salmon fishery is managed under the state of Alaska's limited entry management system. Only holders of "limited entry permits" and their crew are allowed to fish in Bristol Bay. There are approximately 1,860 drift gillnet permits and approximately 1,000 set net permits. Average drift gillnet catches are higher than average set gillnet catches, and drift gillnet fishermen catch about four-fifths of the Bristol Bay sockeye salmon harvest.

When the limited entry system was implemented in the 1970s, permits were allocated for free to fishermen with a history of participation in the fishery. Since then, fishermen have gotten permits only by gift, inheritance or (most commonly) buying them from other fishermen. Permit prices vary with economic conditions in the fishery. In 2010, the average price of a drift net permit was about $102 thousand and the average price of a set net permit was about $29 thousand.

Bristol Bay permit holders fish with an average of about two crew members (larger operations have more crew members), so the total number of Bristol Bay fishermen is approximately three times the number of permit holders. Crew are paid a share of the catch value after deducting food and fuel costs (typically about 10%). Permit holders net earnings depend on the value of their catch minus crew shares and a

variety of other operating costs (the largest of which include food, fuel, nets, maintenance, and transportation) and capital costs (payments for boats and permits).

In 2010, Alaska residents owned 53% of Bristol Bay permits but caught only 42% of the fish. This is because Alaskans owned a smaller share of the drift gillnet permits, and had lower average catches in the drift gillnet fishery. The fact that well over half of the value of Bristol Bay catches goes to residents of other states is a major reason why a large share of the economic impacts of the fishery occur in other states.

Table II-1

Bristol Bay Limited Entry Permit Holders, Catches and Gross Earnings, by State, 2010

	Fishery	Total	Alaska	Washington	Oregon	California	Other
Number of permit holders	Drift	1,850	845	642	98	109	156
	Set	927	629	127	38	34	99
	Total	2,777	1,474	769	136	143	255
	% of total	100%	53%	28%	5%	5%	9%
Number of permits fished	Drift	1,494	650	538	87	87	138
	Set	861	566	124	40	35	100
	Total	2,355	1,216	662	127	122	238
	% of total	100%	52%	28%	5%	5%	10%
Average catch per permit fished (lbs)	Drift	98,542	84,562	112,538	103,907	99,132	101,788
	Set	39,495	38,077	36,323	44,486	44,233	46,215
	Total	76,954	62,925	98,262	85,192	83,382	78,438
Total catch (million lbs)	Drift	147.2	55.0	60.5	9.0	8.6	14.0
	Set	34.0	21.6	4.5	1.8	1.5	4.6
	Total	181.2	76.5	65.0	10.8	10.2	18.7
	% of total	100%	42%	36%	6%	6%	10%
Total gross earnings ($ millions)	Drift	134.1	49.5	55.3	8.4	8.1	12.9
	Set	31.0	19.5	4.2	1.6	1.4	4.2
	Total	165.2	69.0	59.5	10.0	9.5	17.1
	% of total	100%	42%	36%	6%	6%	10%

Source: CFEC Permit and Fishing Activity Data.

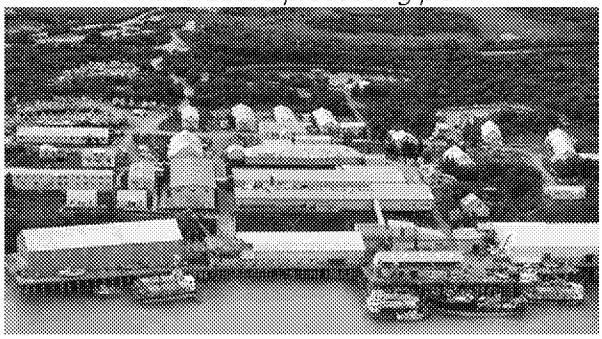
Bristol Bay drift gillnet boats fishing

Bristol Bay Salmon Processing

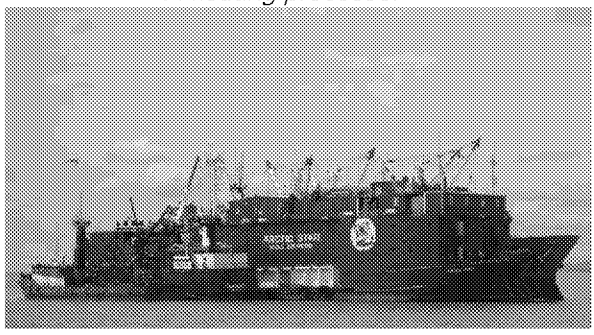
Fish processing is an integral part of the Bristol Bay salmon industry, employing approximately half as many people as fish harvesting and more than doubling the value of the fish. Bristol Bay salmon are processed by about 10 large processing companies (most of which have multiple processing facilities) and 20 smaller companies employing about 5,000 processing workers at the peak of the season. Almost 90% of the processing workers are from other states and live in bunkhouse facilities at the processing plants.

Bristol Bay salmon are processed in both land-based processing facilities and on floating processors. Salmon are canned only in large land-based facilities, which also have salmon freezing capacity. Floating processors produce only frozen salmon.

A land-based processing plant



A floating processor



In 2010, six companies operated salmon canning facilities in Bristol Bay. These included some of the largest seafood processing companies operating in Alaska. Most of these companies have both land-based and floating processing operations in many parts of Alaska, which process not only salmon but other major Alaska species as well, such as pollock, crab and halibut. The home offices of all of the large Bristol Bay processors are in or near Seattle.

Table II-2

Large Bristol Bay Salmon Processors and Buyers, 2010

Type of processor	Company	Home Office Location	Types of processing capacity				Shipping*	
			Canned	Frozen	Fresh	Cured	Air	Sea
Major processors with both canning and freezing capacity	Peter Pan Seafoods, Inc.	Seattle, WA	X	X	X	X	X	X
	Icicle Seafoods, Inc.	Seattle, WA	X	X	X		X	X
	Ocean Beauty Seafoods, Inc.	Seattle, WA	X	X	X		X	X
	Trident Seafoods	Seattle, WA	X	X	X		X	X
	Yard Arm Knot Fisheries, LLC	Seattle, WA	X	X				X
	Alaska General Seafoods	Kenmore, WA	X	X	X		X	
Other large processors	Leader Creek Fisheries, LLC	Seattle, WA		X				X
	Snopac Products, Inc.	Seattle, WA		X	X		X	X
	Pederson Point	Seattle, WA		X				X
	Togiak Fisheries	Seattle, WA		X				X
	Ekuk Fisheries	Seattle, WA		X	X		X	X

Note: Other Bristol Bay processors in 2010 included seven buyers with both frozen and fresh capacity; nine buyers with only frozen capacity, and eight buyers with only fresh or cured capacity.

*How processors/buyers shipped products from Bristol Bay

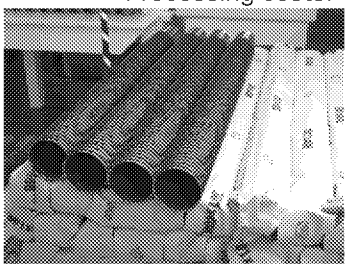
Source: Alaska Department of Fish and Game, Bristol Bay Annual Management Report 2010, Table 25.

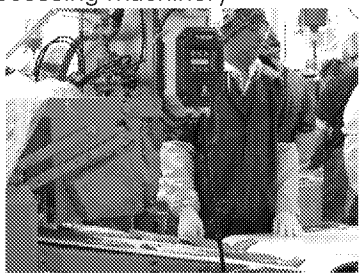
A processing worker holding a sockeye salmon

Workers cleaning salmon

Fish account for the largest share of costs of Bristol Bay processors. Other important costs include labor, fish tendering, packaging (boxes and cans), transportation of products and workers, utilities, maintenance, and capital costs of equipment and buildings. Processing costs per pound vary between product forms and from year to year as fixed costs are spread over different volumes of salmon.

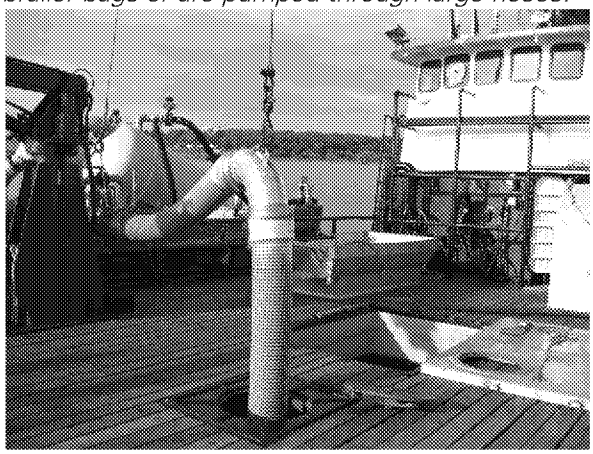
Processing costs: salmon cans (stacked in tubes), boxes, processing machinery





Most larger Bristol Bay salmon processors contract with tender vessels to transport salmon from fishing vessels at or near the best fishing areas to land-based or floating processing facilities. Tendering represents a significant cost for the industry.

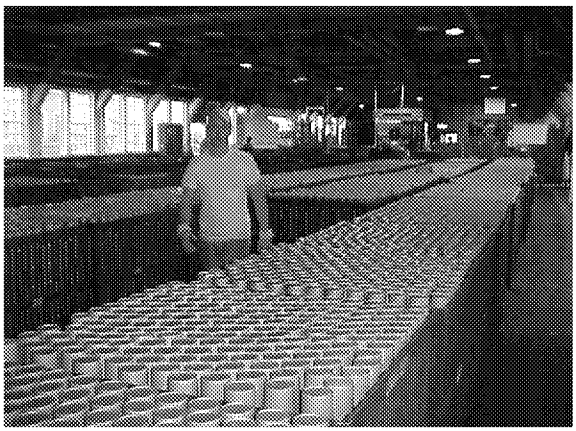
Fish are transferred from fishing boats to tenders in brailer bags or are pumped through large hoses.



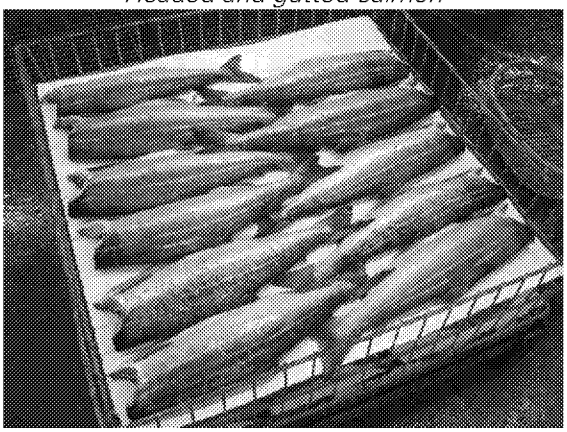
Bristol Bay Salmon Products

Bristol Bay salmon are processed into four major *primary products*: frozen salmon, canned salmon, fresh salmon, and salmon roe. Frozen salmon includes both headed and gutted (H&G) salmon as well as salmon fillets.

Canned salmon



Headed and gutted salmon



Bristol Bay sockeye salmon fillet

Processing Bristol Bay sockeye salmon roe

In 2010, frozen salmon accounted for 69% of Bristol Bay production volume, followed by canned salmon (26%), salmon roe (3%) and fresh salmon (2%). The shares of different product forms in Bristol Bay production vary from year to year, reflecting variations in harvests as well as variations in the relative prices of different products.

Bristol Bay Salmon Prices and Value

Two kinds of prices and values matter for the Bristol Bay salmon industry. *Ex-vessel prices* are the prices processors pay fishermen for their fish. The *ex-vessel value* is the ex-vessel price times the harvest volume, or fishermen's gross earnings. *First wholesale prices* are the prices customers (typically large retail chains, wholesalers, and importers in other countries) pay processors for the frozen, canned, fresh and other products they produce. The *first wholesale value* is the sum of the different wholesale prices times the product volumes sold, or processors' gross earnings.

Bristol Bay salmon prices and value can vary widely from year to year and over longer periods of time, reflecting changes in salmon market conditions and in harvests. Prices rose dramatically during the 1980s because of strong Japanese market demand. From the late 1980s to the early 2000s prices fell dramatically. The main cause of the decline was competition from rapidly growing production of farmed salmon. Other factors included a slowdown in the Japanese economy and competition from Russian and Japanese wild salmon—as well as large Alaska harvests.

Figure II-3

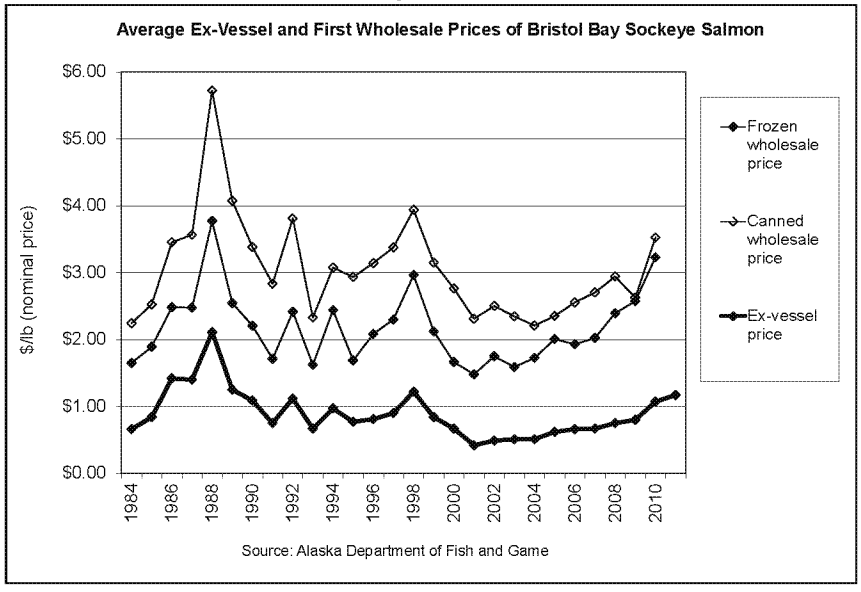
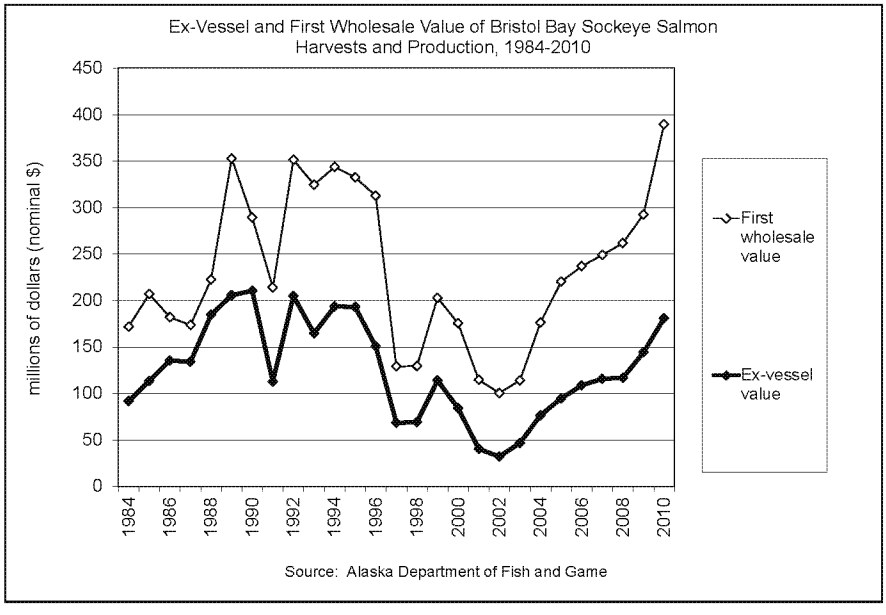


Figure II-4[1]



[1] ADF&G and CFEC report different ex-vessel values for Bristol Bay salmon in 2010. Our economic impact analysis is based on CFEC data. The data in this figure and in Table II-3 below are based on ADF&G data. For discussion, see Appendix A, Ex-Vessel Value of Bristol Bay Salmon Harvests.

Since 2002, Bristol Bay salmon prices have rebounded dramatically, due to growing world salmon demand, development of new product forms such as salmon fillets and portions, improved fish handling and quality, diversification of markets, and sustained and effective marketing by Alaska processors and the Alaska Salmon Marketing Institute. These favorable market trends are likely to continue, although global economic conditions and global salmon supply will continue to affect market conditions, leading to lower prices in some years (as occurred in 2012).

Both prices and catches affect the ex-vessel and first-wholesale value of Bristol Bay salmon. Both lower prices and lower catches contributed to the decline in value during the 1990s. Both higher prices and higher catches contributed to the recovery in value since 2002. (Data for 2011 and 2011 were not yet available, but first wholesale value likely fell due to lower catches in both years, and lower prices in 2012).

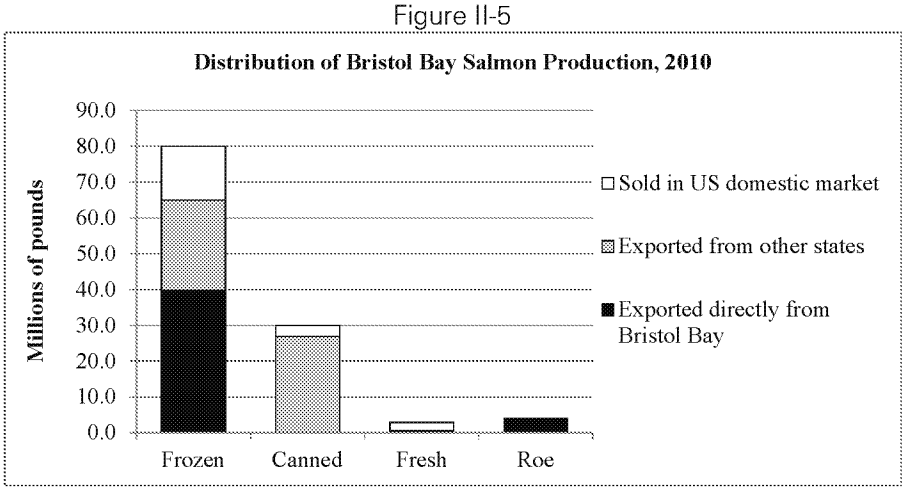
Bristol Bay Salmon End Markets

End markets for Bristol Bay salmon vary widely for different product forms. Prior to the mid-1990s, almost all Bristol Bay *frozen salmon* was shipped to Japan, and the industry was very dependent on Japanese salmon market conditions. Since then the Japanese market share has declined dramatically. Major markets for Bristol Bay frozen salmon now include not only Japan but also the United States, the European Union, and China (where frozen salmon is reprocessed into value-added products and re-exported to global markets).

Currently about half of Bristol Bay frozen salmon is exported directly from Bristol Bay, primarily to Japan and China. Most of the remaining frozen salmon is shipped to Washington where much of it is repackaged and/or reprocessed into secondary products such as fillets, portions and smoked salmon. Some of these products are exported while the rest are sold in the US domestic market.

Bristol Bay *canned salmon* is shipped to warehouses in Washington and Oregon where it is stored, labeled, and sold by processors over the course of the year, mostly to the United Kingdom and other export markets. Small volumes of *fresh salmon* are shipped by air to the Lower 48 states and Canada. Almost all sockeye salmon *roe* is exported, mostly to Japan and Russia.

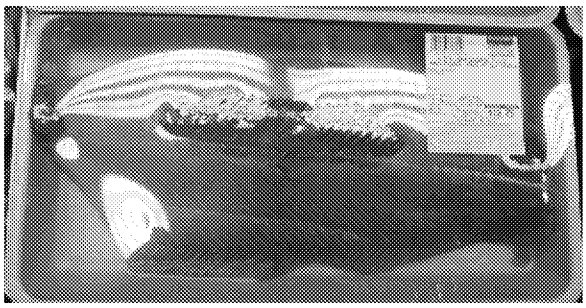
Figure II-5



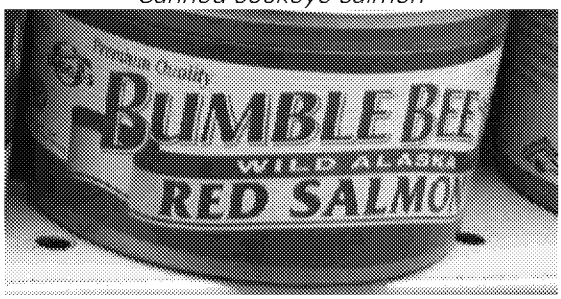
Appendix C

Major US sockeye salmon retail products

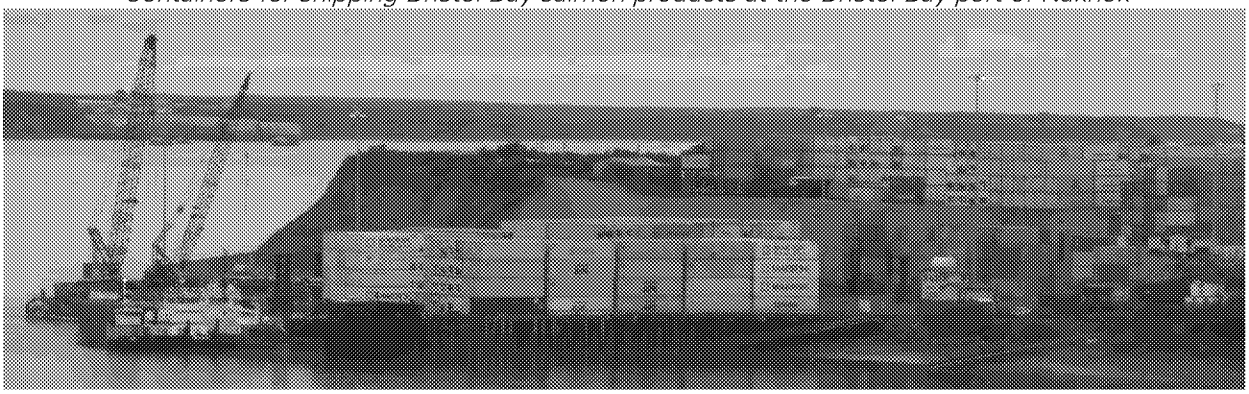
Salmon fillet



Canned sockeye salmon



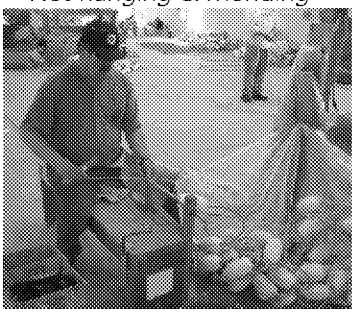
Containers for shipping Bristol Bay salmon products at the Bristol Bay port of Naknek



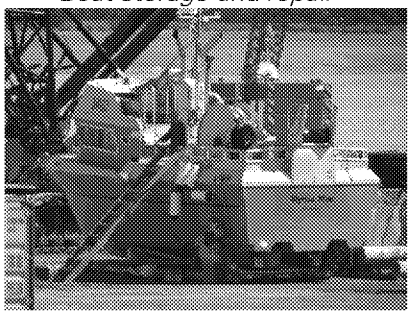
Bristol Bay Salmon Support Industries

The Bristol Bay salmon industry is much more than fishing and processing. A wide range of industries provide supplies and services to the industry. Some of these, such as those pictured above and below, are based in Bristol Bay. Most are based in other states—particularly Washington—such as marine transportation companies, boat builders, machinery and electronics suppliers, packaging manufacturers, banks and insurance companies. As a Bristol Bay processor told us, "Bristol Bay banks in Seattle." More generally, Bristol Bay *shops* in Seattle—which is another reason why a large share of the economic impacts of the Bristol Bay salmon industry occur in Washington.

Net hanging & mending

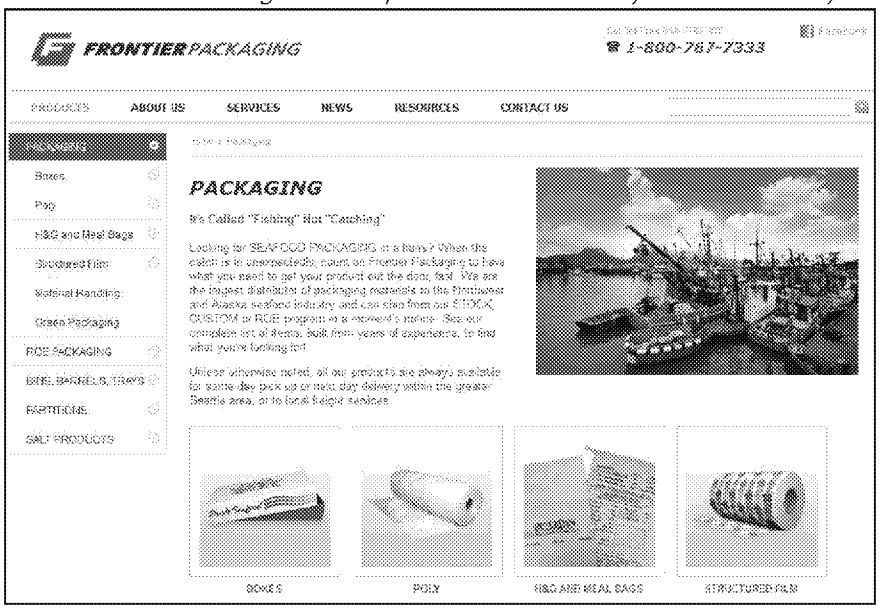


Boat storage and repair



Air freight

Located in Washington—but part of the Bristol Bay salmon industry



Relative Scale of Bristol Bay Salmon Industry

The Bristol Bay salmon fishery is a world-scale commercial salmon fishery. Between 2005 and 2010, Bristol Bay averaged 67% of total Alaska sockeye salmon harvests (by volume), 50% of world sockeye salmon harvests, 21% of all Alaska wild salmon harvests, and 8% of all world wild salmon harvests. It accounted for 31% of the ex-vessel value of all Alaska wild salmon harvests, 13% of the ex-vessel value of all world wild salmon harvests, and 3% of the value of all United States fish and shellfish harvests. In 2010, the ex-vessel value of Bristol Bay salmon harvests exceeded the total ex-vessel value of fish harvests in all but nine states (not counting Alaska).

These numbers are inadequate to convey the scale of the Bristol Bay salmon industry. It is difficult to appreciate the scale of the industry without seeing it in person—thousands of fishing boats spread out across vast fishing districts, hundreds of other vessels ranging from tenders to floating processors and ocean freighters, and dozens of processing operations with thousands of workers processing tens of millions of fish.

Table II-3

Selected Indicators of the Relative Scale of the Bristol Bay Salmon Industry

Measure		2005	2006	2007	2008	2009	2010	Average
Bristol Bay sockeye salmon harvest volume as a share of:	Alaska sockeye salmon	58%	69%	62%	71%	71%	70%	67%
	World sockeye salmon	47%	49%	47%	52%	55%		50%
	Alaska wild salmon (all species)	16%	22%	18%	23%	25%	21%	21%
	World wild salmon (all species)	7%	8%	7%	9%	7%		8%
Bristol Bay sockeye salmon ex-vessel value as a share of:	Alaska wild salmon ex-vessel value (all species)	30%	32%	28%	27%	36%	31%	31%
	World wild salmon ex-vessel value (all species) *	15%	15%	14%	12%	11%		13%
	United States fish & shellfish landed value (all species)	2%	3%	3%	3%	4%	4%	3%

* Valued at average prices of Alaska wild salmon, by species.

Note: Complete world wild salmon supply data not available for 2010.

Sources: Alaska data: ADFG Alaska Commercial Salmon Harvests and Ex-vessel Values Reports and CFEC Basic Information Tables data. Other wild salmon supply data: FAO FishstatJ database (Canada, Japan, Russia), National Marine Fisheries Service (US Pacific Northwest data).

Table II-4

Ex-Vessel Value of Total Fishery Landings for Selected States Compared with the Ex-Vessel Value of Bristol Bay Salmon Harvests, 2010

State	Ex-vessel value (millions of dollars)	Ratio of total state ex-vessel value to Bristol Bay ex-vessel value	Ratio of Bristol Bay ex-vessel value to total state ex-vessel value
Alaska	1584.0	9.59	0.10
Massachusetts	478.5	2.90	0.35
Maine	375.1	2.27	0.44
Washington	272.3	1.65	0.61
Louisiana	247.9	1.50	0.67
Texas	204.1	1.24	0.81
Virginia	198.8	1.20	0.83
California	189.3	1.15	0.87
Florida	184.4	1.12	0.90
New Jersey	177.9	1.08	0.93
Bristol Bay salmon	**165.2**	**1.00**	**1.00**
Oregon	104.6	0.63	1.58
Maryland	95.9	0.58	1.72
Hawaii	84.0	0.51	1.97
North Carolina	79.9	0.48	2.07
Rhode Island	62.6	0.38	2.64
All other states	180.0	1.09	0.92
Total, all states	4519.5	27.36	0.04

Source: National Marine Fisheries Service, *Fisheries of the United States, 2010.*

Data sources for this chapter

Historical salmon catches (1878-1997) are from Byerly et al (1999). Other salmon harvest data are from ADFG Alaska Commercial Salmon Harvests and Ex-vessel Values Reports. Numbers of permits and average 2010 permit prices are from CFEC Basic Information Tables. Ex-vessel prices are from ADFG Salmon Ex-Vessel Price Time Series by Species 1984-2008. Ex-vessel value is from ADFG Alaska Commercial Salmon Harvests and Ex-vessel Values Reports. First wholesale prices and value are from ADFG COAR data. World salmon harvest data used to calculate shares of world harvests are from FAO FishstatJ database and NMFS Commercial Fishery Landings database. For details of these data sources, refer to Appendix F.

III. OVERVIEW OF STUDY METHODOLOGY

The *economic impacts* of an industry are the jobs, income and output value (sales) created by the industry—or the jobs, income and output value that would not exist if the industry did not exist. For this study, we estimated economic impacts of the Bristol Bay salmon industry for the United States nationally and for the four west-coast states of Alaska, Washington, Oregon and California. This chapter provides an overview of our methodology for estimating economic impacts.

Types of Economic Impacts

Economic impacts may be divided into *direct economic impacts* and *multiplier economic impacts.*

- *Direct economic impacts* of the Bristol Bay salmon industry are the jobs, income and output value created in those businesses directly involved in fishing for, processing, distributing and retailing Bristol Bay salmon.

- *Multiplier economic impacts* are the jobs, income and output value created in other industries.

Multiplier economic impacts include both indirect impacts and induced impacts. *Indirect economic impacts* are the jobs, income and output value created by the ripple effects of business purchases. *Induced economic impacts* are the jobs, income and output value created by the ripple effects of household purchases.

When Bristol Bay fishermen buy nets, they create indirect impacts in the net manufacturing industry. When Bristol Bay fishermen get haircuts, they create induced impacts in the hair-cutting industry.

Distribution Chain Stages for Which We Estimated Economic Impacts

We estimated direct and multiplier economic impacts for three stages of the distribution chain for Bristol Bay salmon in the United States:

- *Fishing and primary processing in Bristol Bay*

- *Shipping and secondary processing.* This included:

    - Marine transportation of frozen salmon to Washington state
    - Secondary processing of Bristol Bay frozen salmon in Washington State.
    - Marine transportation of canned salmon to Washington and Oregon
    - Warehousing and labeling of canned salmon in Washington and Oregon

- *Distribution and retailing.* This included nationwide transportation, wholesaling and retailing of Bristol Bay salmon products in stores and restaurants throughout the United States, including frozen salmon, canned salmon and fresh salmon. Technically, as discussed below, the economic effects of distribution and retailing are economic *contributions* rather than economic *impacts.*

We refer to the stages of the distribution chain after Bristol Bay (shipping and secondary processing, and distribution and retailing) as *downstream* stages of the distribution chain, and we refer to their economic impacts as *downstream economic impacts.*

Geographic Regions for Which We Estimated Economic Impacts

As shown in Table III-1, we estimated economic impacts of these three stages of the Bristol Bay salmon distribution chain for different combinations of geographic regions. We estimated economics impacts of fishing and primary processing in Bristol Bay for the United States nationally as well as for the four west coast states of Alaska, Washington, Oregon and California. We estimated economic impacts for "other states" by subtracting estimated economic impacts for the four west coast states from estimated national economic impacts.

We estimated economic impacts of shipping to and secondary processing in Washington and Oregon for the United States as well as for the states of Washington and Oregon. We estimated economic contributions of nationwide distribution and retailing only for the United States as a whole, because we lacked sufficient data to develop estimates of these contributions for individual states.

Table III-1

Types of Economic Impacts and Contributions of the Bristol Bay Salmon Industry Estimated in This Report

Impact driver	Types of Impacts & Activity	United States	Alaska	Washington	Oregon	California	Other states**
Fishing and processing in Bristol Bay	Direct impacts	X	X	X	X	X	X
	Indirect impacts	X	X	X	X	X	X
	Induced impacts	X	X	X	X	X	X
	Multiplier impacts*	X	X	X	X	X	X
	Total impacts	X	X	X	X	X	X
Shipping to and secondary processing in Washington & Oregon	Direct impacts	X		X	X		
	Indirect impacts	X		X	X		
	Induced impacts	X		X	X		
	Multiplier impacts*	X		X	X		
	Total impacts	X		X	X		
Nationwide distribution and retailing	Direct contribution	X					
	Indirect contribution	X					
	Induced contribution	X					
	Multiplier contribution	X					
	Total contribution	X					

* Multiplier impacts are the sum of indirect and induced impacts. **Estimated by subtracting impacts estimated for the four western states from impacts estimated for the US.

Estimation of Economic Impacts for 2010

The economic impacts of the Bristol Bay salmon fishery vary from year to year due to variation in Bristol Bay salmon catches, prices, the mix of products produced, fishery participation, employment and other fishery characteristics. For this report, we estimated economic impacts of the Bristol Bay salmon industry in 2010. We chose 2010 because it was the most recent year for which comprehensive economic data were available at the time we began this study.

In the recent past, Bristol Bay salmon harvests, prices and value—and the economic impacts they drive—have been both higher and lower than they were in 2010. Similarly, in the future, there will likely

be years when harvests, prices, value and economic impacts of the Bristol Bay salmon industry will be higher and lower than they were in 2010. The economic impacts of the Bristol Bay salmon industry are *not* equal every year to the impacts we estimated for 2010. However, the economic impacts of the Bristol Bay salmon industry in 2010 *do* provide a reasonable illustration of the overall scale and nature of the economic impacts of the industry and the distribution of those impacts between states.

Methodology for Estimating Economic Impacts

Direct Economic Impacts of Bristol Bay Salmon Fishing and Processing

The direct economic impacts of Bristol Bay salmon fishing and processing are the employment, income and output value created in fishing and processing operations in Bristol Bay. To estimate direct economic impacts, we relied primarily on data and estimates published by several Alaska state agencies, including the Alaska Commercial Fisheries Entry Commission (CFEC), the Alaska Department of Fish and Game (ADF&G), and the Alaska Department of Labor and Workforce Development (ADLWD). Chapter IV describes our estimates of these direct economic impacts, and Appendix A provides technical details of our data, assumptions and analysis.

Multiplier Economic Impacts of Bristol Bay Salmon Fishing and Processing

The multiplier economic impacts of Bristol Bay salmon fishing and processing are the indirect and induced employment, income and output value resulting from the fishing and processing that occurs in Bristol Bay. We followed a three-stage process to estimate multiplier economic impacts.

First, we estimated how the value created by the Bristol Bay salmon industry in 2010 was divided up. In 2010, Bristol Bay salmon processors were paid a total first wholesale value of $390 million for the salmon products they produced in the Bristol Bay fishery. All of this money was paid to someone for something: either for the labor of fishing crew and processing workers, for fishermen's and processors' purchases from other businesses, or as returns to the investments of permit holders and processing company owners in fishing permits, fishing gear and processing plants.

As discussed in Chapter V, we estimated that in 2010 processors paid $165 million to salmon permit holders. Of the remaining $225 million, we estimated that processors paid $34 million for labor, $23 million for packaging, $7 million for insurance, and so on for many other types of payments. Of the $165 million paid to salmon permit holders, we estimated that they paid $37 million to fishing crew, $5 million for transportation, and so on for many other types of payments.

Second, we estimated what states each type of payment went to. For example, we estimated that of the $34 million processors paid for labor, $4 million went to residents of Alaska, $9 million went to residents of Washington, and so forth. We estimated that of the $23 million processors spent for packaging, they spent $14 million in Washington and $9 million in California. We estimated that of the $5 million fishermen spent for transportation, they spent $2 million in Alaska, $2 million in Washington, and $1 million in other states.

Our estimates for these first two steps—estimating how the $390 million in value created by the Bristol Bay salmon industry was divided up, and what states it went to—were based on State of Alaska data for

permit holders' and processing workers' earnings, earlier studies of permit holders' costs, discussions with industry sources, and our best judgment.

Third, we used IMPLAN input-output models to estimate the multiplier economic impacts (indirect and induced impacts) resulting from different types of payments to different states to calculate the multiplier economic impacts of Bristol Bay salmon and fishing nationally and in the four west coast states. The input-output models track the ripple effects of payments as money flows through the economy. For example, when salmon processors buy cans for canning salmon, it creates jobs and income in the can manufacturing industry. In turn the can manufacturers buy metal and machines to make the cans, which creates jobs in the metal mining and machine manufacturing industries. Input-output models track and add-up all of these effects to calculate multiplier impacts.

Chapter V describe our estimates of the multiplier economic impacts of Bristol Bay salmon fishing and processing, and Appendix B provides technical details of our data, assumptions and analysis. Appendix D provides technical details of our use of IMPLAN input-output models.

Downstream Economic Impacts

The downstream economic impacts of the Bristol Bay salmon industry are the economic impacts resulting from transporting, processing and retailing Bristol Bay salmon products within the United States after they leave Bristol Bay. We followed a three-stage process to estimate downstream economic impacts.

First, we estimated end-markets for Bristol Bay salmon products. A large share of Bristol Bay salmon is exported. We subtracted estimated exports from total production to estimate how much Bristol Bay salmon is transported within, processed in and sold in the United States. Second, we estimated the increase in value in the "downstream" industries involved in transporting, processing and retailing Bristol Bay salmon products in the United States. Third, we used IMPLAN input-output models to estimate the multiplier economic impacts (indirect and induced impacts) resulting from payments by downstream industries. Chapter VI describe our estimates of downstream economic impacts of Bristol Bay salmon, and Appendix C provides technical details of our data, assumptions and analysis.

In estimating national economic contributions of distribution and retailing, we had no data on the costs associated with distribution and retailing or the prices at which products were sold at retail. It was far beyond the scope of this project to collect this kind of information. For this reason, for our analysis we made the simple and conservative assumption that distribution and retailing increases the value of Bristol Bay salmon products by an average of 50%. Our estimates of the economic contribution of the distribution and retailing of Bristol Bay salmon should be interpreted as estimates of *what the associated jobs, income and output value would have been if the average increase in value were 50%*, rather than as a precise estimate of what they were. It is likely that the actual economic contributions associated with distribution and retailing in 2010 were at least as high as our estimates, and possible that they were significantly higher.

Appendix C

Definitions for Selected Economic Terms Used in this Report

Economic contribution and economic impact. Economists distinguish between two closely related concepts: *economic contribution* and *economic impact*. Economic contribution is the jobs, income and output value associated with an industry. It is sometimes called *economic activity*. Economic impact is the *net* jobs, income and output value associated with an industry—or how total jobs, income and output value in the economy would change if the industry didn't exist.

As a simple example, if the movie theaters in a town employ 100 people, their direct economic contribution is 100 jobs. But if closing the movie theaters would cause people to spend more time bowling, resulting in 40 new bowling alley jobs, then the economic impact of the movie theaters is only 60 jobs. For some industries, it can be much harder to estimate economic impacts than economic contribution, because it's hard to know how the economy might change if the industries didn't exist.

All of the fishing and processing jobs in Bristol Bay, and their multiplier effects, are economic *impacts*, because they would all disappear if the fishery didn't exist. But not all of the jobs in the retail stores which sell Bristol Bay salmon products are economic impacts, because consumers would buy more of other kinds of fish (and other products) if they couldn't buy Bristol Bay salmon. In this report, we estimate the *economic impacts* of fishing and processing in Bristol Bay, as well as transportation of Bristol Bay products to other states and secondary processing in other states. We estimate the *economic contribution* of distribution and retailing of Bristol Bay salmon. We use the term *economic impacts* to describe the combined effects of all the distribution stages of Bristol Bay salmon, although technically the distribution and retail stage is *economic contribution* rather than *economic impact.*

Payments. In discussing our economic impact modeling assumptions we use the term *payments* to describe payment flows between industries. Economists usually call these *expenditures*.

Output value. We use the term *output value* to mean the total value of the output of an industry, as measured by its total sales. Economists often use the terms *output* or *sales* to refer to the total sales of an industry.

Value increase. We use the term *value increase* or *increase in value* to mean the *increase in value of fish or fish products associated with a particular stage of the harvesting, processing and distribution chain for Bristol Bay salmon*. For example, we say that the "increase in value in processing" for Bristol Bay salmon in 2010 was $225 million, or the difference between the total first wholesale value paid to processors ($390 million) and the total ex-vessel value paid to fishermen ($165 million). Occasionally we use the term *value added* or *adds to value* with the same meaning. This differs from the technical economic definition of "value added" used in the US national income accounting system and in the IMPLAN economic output models. Technically, "value added" refers only to the labor income, proprietor income (profit), and indirect business taxes generated by an industry, and excludes payments to other businesses.

Appendix C

Data Limitations and Assumptions

Reliable data are available for some of the most important measures of the economic importance of the Bristol Bay salmon industry. These include, in particular, data for the "ex-vessel" value of fish catches (the value paid to fishermen), the first wholesale value of fish production, numbers and residency of fishing permit holders, and fish processing employment and wages. These data alone are sufficient to conclusively show that the Bristol Bay salmon industry is very large and economically important, not only for Alaska but also for other states—particularly Washington—and for the United States.

However, data are *not* publically available for the payments by the fishing and processing industries to other industries, the distribution of these payments among different states, the volumes of salmon entering different "downstream" distribution channels, or the payments from downstream industries. It was far beyond the scope of this study to undertake the kinds of detailed surveys of fishermen, processors and downstream industries which would have been necessary to develop statistically reliable estimates for these types of data.

Given this lack of data, to estimate economic impacts of Bristol Bay fishing and processing for the four west coast states, and to estimate downstream economic impacts, we needed to make numerous assumptions about payments by fishermen, processors and downstream industries. To do this we relied on our best judgment, based on many years of observing and studying the industry and on discussions with fishermen, processors and industry suppliers and previous surveys of Bristol Bay fishing permit holders. We document and discuss these assumptions in Appendixes A-D.

It is important to note that not all of our assumptions are equally important for our analysis. For example, if payments by the processing industry to two supplier industries have similar economic impacts in the same location, then it doesn't particularly matter if our assumptions about the allocation of payments between these the two industries are accurate. Similarly, our assumptions about relatively small payments (such as for local Bristol Bay property taxes) matter less than our assumptions about large payments (such as payments to fishing crew and processing workers).

Given the many assumptions we had to make, how accurate are our estimates of economic impacts of the Bristol Bay salmon industry? They are not precise. It would be impossible to measure the magnitude of each kind of economic impact of the Bristol Bay salmon industry in 2010 exactly.

However, our estimates are reasonable measures of the relative scale of the economic impacts of the Bristol Bay salmon industry in 2010, as well as the relative scale of the economic impacts on different states and at different stages of the distribution chain. More importantly, because Bristol Bay salmon catches and prices vary from year to year, the ex-vessel and first wholesale value—which are the key drivers of economic impacts—also vary from year to year (as shown by Figure II-4 in the previous chapter). Given this variability, having more precise estimates of the economic impacts in 2010 would not be particularly helpful in thinking about the longer-term economic importance of the industry. We can be highly confident the economic impacts of the Bristol Bay salmon industry in 2015 will be similar in scale to what they were in 2010. But even if we knew exactly what these economic impacts were in 2010, we couldn't know what its exact economic impacts will be in 2015.

Appendix C

Other Ways in Which the Bristol Bay Salmon Industry is Economically Important

Our analysis for this report applies standard input-output modeling methodology to estimate economic impacts of the Bristol Bay salmon industry. However, standard economic impact analysis does not account for all the ways the Bristol Bay salmon industry is economically important nationally and to west coast states.

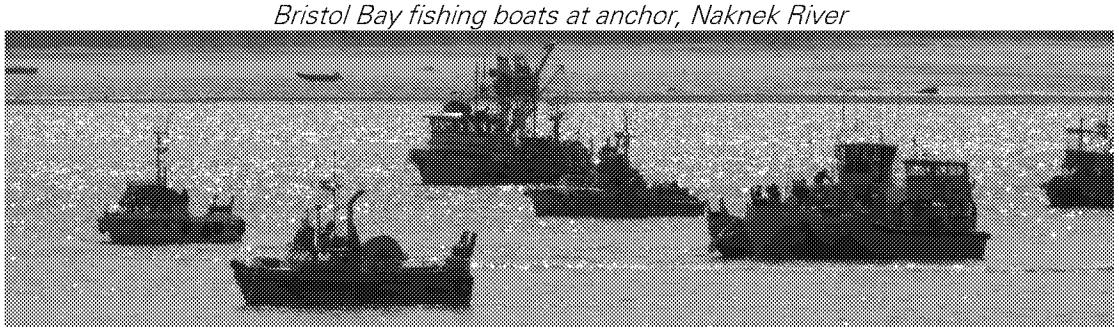
The estimated value of Bristol Bay salmon exports in 2010 was $252 million. Although exported Bristol Bay salmon products do not create "downstream" economic impacts in the United States, they contribute significantly to the United States balance of trade, helping to maintain the value of the dollar and pay for imports.

The Bristol Bay salmon industry is a major part of the broader Alaska and Pacific Northwest seafood industry, and pays for an important share of the fixed costs of many fishing and processing operations. Without the Bristol Bay salmon industry, fixed costs would be higher and profits lower in the rest of the seafood industry.

The Bristol Bay salmon industry is a major supporter of infrastructure and utilities in the Bristol Bay region, a major taxpayer, and a very important source of local jobs and income.

A Bristol Bay salmon fisherman

Bristol Bay fishing boats at anchor, Naknek River



IV. DIRECT ECONOMIC IMPACTS OF BRISTOL BAY SALMON FISHING AND PROCESSING

The direct economic impacts of Bristol Bay salmon fishing and processing are the employment, income and output value created in Bristol Bay every summer in the fishing and processing industries. Table IV-1 shows our estimates of these direct economic impacts. In this chapter, we discuss these impacts. Appendix A provides technical details of how we estimated them, as well as sources for all of the data and estimates in this chapter.

Table IV-1

Estimated Direct Economic Impacts of Bristol Bay Salmon Fishing and Processing, 2010

	Total US	AK	WA	OR	CA	Other states
Seasonal employment	11,921	4,369	3,227	553	2,143	1,629
Annual average employment	1,987	728	538	92	357	271
Income ($ million)	143.7	50.1	48.2	8.1	18.9	18.4
Output value ($ million)	389.7	126.7	198.5	13.4	19.4	31.7

Sources: See discussion in Appendix A. Note: Direct employment and income impacts are allocated to the states in which workers were residents. Direct output value impacts are allocated to the states to which payments were made.

Bristol Bay Fishing and Processing Employment

Almost 12,000 people worked in Bristol Bay salmon fishing and processing during the 2010 salmon season (Table IV-2 and Figure IV-1). About 7000 worked in fishing and almost 5,000 worked in processing.

Direct employment in the Bristol Bay salmon industry is widely spread across several states, employing large numbers of not only Alaska residents but also Washington, Oregon and California residents. Alaska residents held the most fishing jobs (about 4400) followed by Washington residents (about 3200). In contrast, California residents held the most processing jobs (about 1800) followed by Washington residents (about 1300).

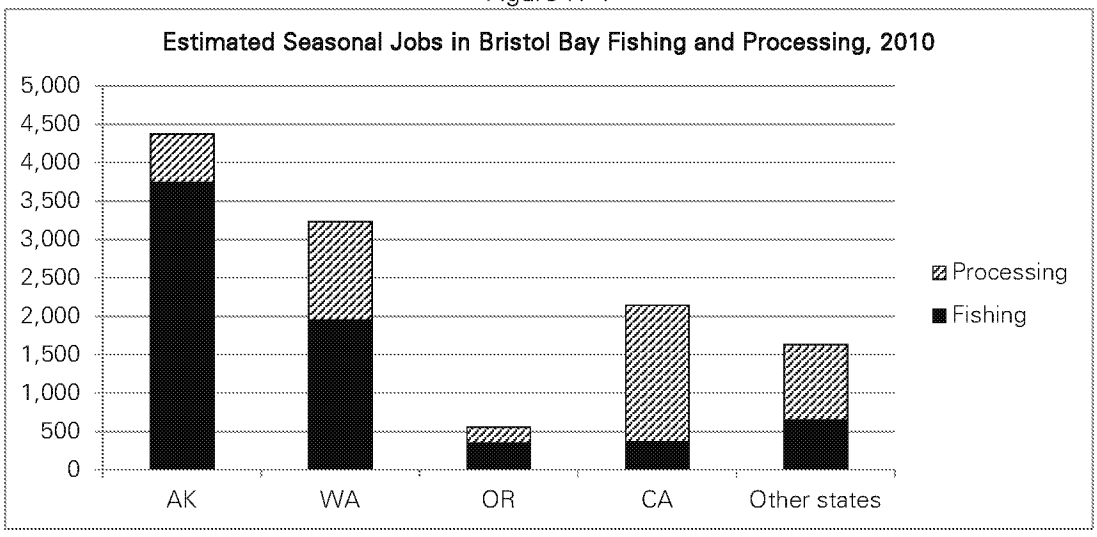
Table IV-2

Estimated Seasonal Jobs in Bristol Bay Salmon Fishing & Processing, 2010

	Total	AK	WA	OR	CA	Other states
Fishing	7,035	3,734	1,948	345	362	646
Processing	4,886	635	1,279	208	1,781	983
Total	**11,921**	**4,369**	**3,227**	**553**	**2,143**	**1,629**

Note: Estimates are by workers' state of residence.

Figure IV-1



Employment impacts are generally expressed in terms of annual average employment. To estimate annual average employment in Bristol Bay salmon fishing and processing, we assumed that fishing and processing jobs last two months on average. Thus our annual average employment estimates (Table IV-3) are simply one-sixth of our seasonal employment estimates.

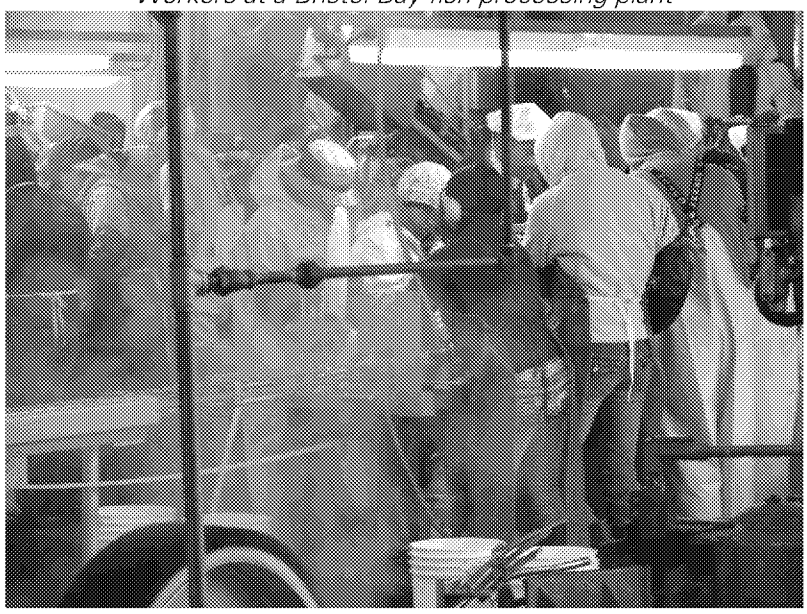
Table IV-3

Estimated Annual Average Employment in Bristol Bay Salmon Fishing & Processing, 2010

	Total	AK	WA	OR	CA	Other states
Fishing	1,173	622	325	57	60	108
Processing	814	106	213	35	297	164
Total	**1,987**	**728**	**538**	**92**	**357**	**271**

Note: Estimates are by workers' state of residence.

Workers at a Bristol Bay fish processing plant



Bristol Bay Fishing and Processing Income

Bristol Bay fishermen and processing workers earned a total of about $144 million in 2010. Fishermen earned much more on average (about $15,600 per seasonal job) than processing workers (about $6,950 per seasonal job). Fishermen's earnings include earnings of both crew (who earn relatively less on average) and permit holders (who earn relatively more on average).

Table IV-4

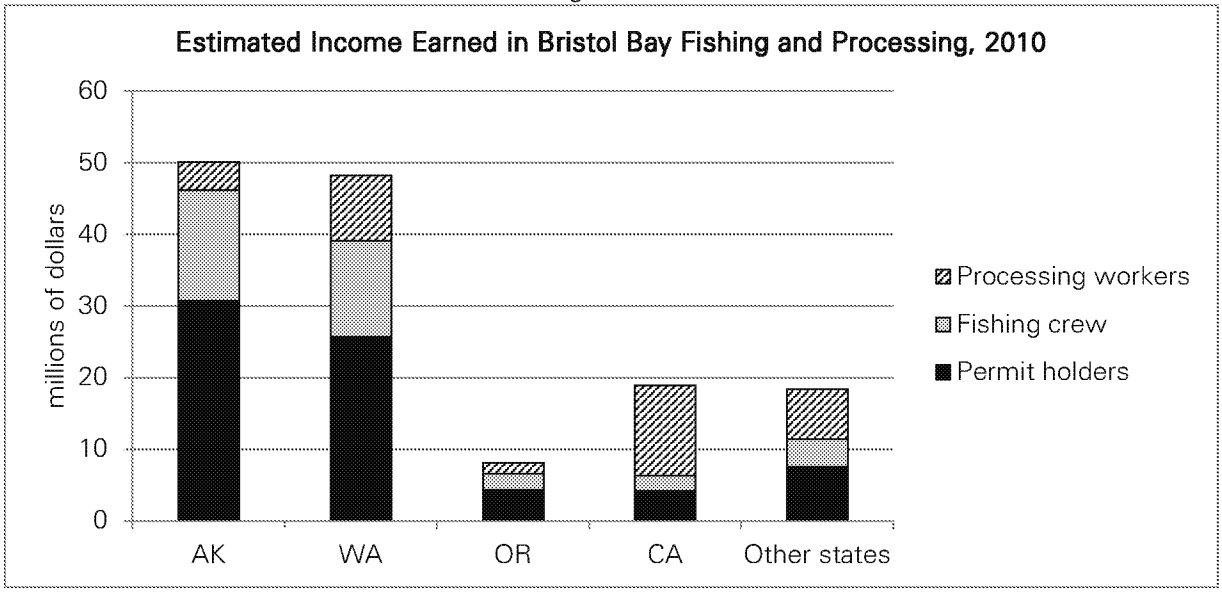
Estimated Income Earned in Bristol Bay Salmon Fishing and Processing, 2010 ($ millions)

	Total	AK	WA	OR	CA	Other states
Fishing crew	37.1	15.5	13.4	2.2	2.1	3.8
Permit holders*	72.7	30.8	25.8	4.4	4.2	7.6
Fishermen, total	*109.7*	*46.2*	*39.2*	*6.6*	*6.3*	*11.4*
Processing workers	34.0	3.9	9.0	1.5	12.6	6.9
Total	**143.7**	**50.1**	**48.2**	**8.1**	**18.9**	**18.4**

*Estimated permit holder net income after expenses. Note: Estimates are by state of residence of income recipients.

Even though fewer Washington residents worked in Bristol Bay, Washington residents earned almost as much income working in Bristol Bay—almost $50 million—as Alaska residents. This is because Washington residents earned much more on average from fishing ($20,100) than Alaska residents ($12,400). (Appendix Table A-3 provides more details about gross earnings of permit holders, by state).

Figure IV-2



Bristol Bay Output Value

The total output value of Bristol Bay fishing and processing in 2010—equal to the first wholesale value paid to processors for all the salmon products produced in Bristol Bay—was $390 million.

Table IV-5

Estimated Direct Output Value of Bristol Bay Salmon Fishing and Processing, 2010 (millions of dollars)

	Total	AK	WA	OR	CA	Other states
Fishing	165.2	83.3	55.6	7.2	6.8	12.3
Processing	224.5	43.4	142.9	6.3	12.6	19.4
Total	389.7	126.7	198.5	13.4	19.4	31.7

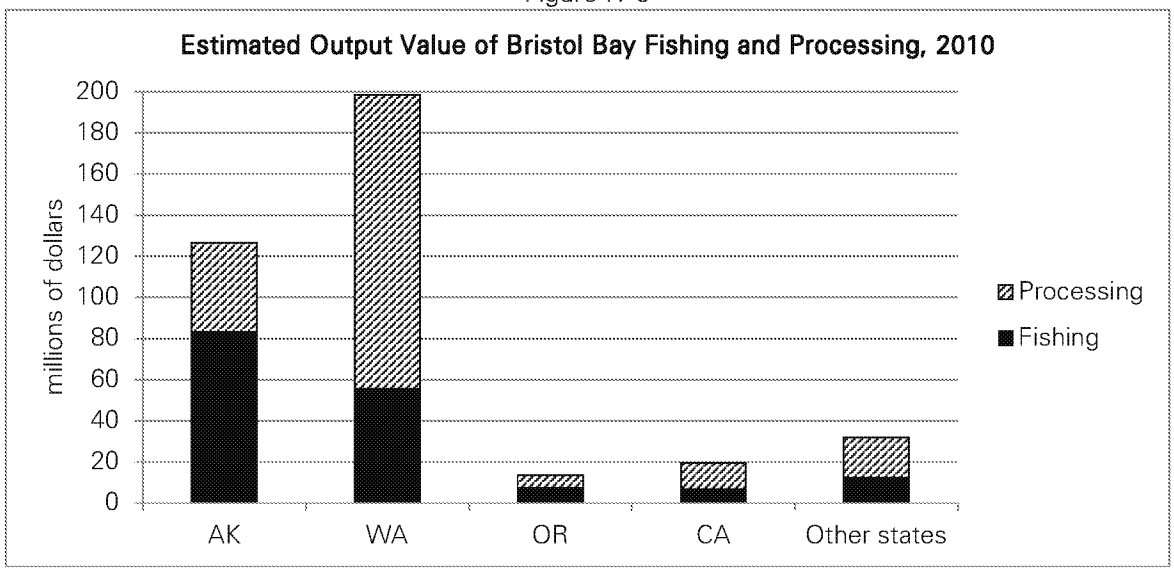
Note: Impacts are allocated to the states to which estimated payments from output value were made.

Of this, fishing contributed $165 million in output value—the ex-vessel value paid to fishermen. Processing contributed the remaining $225 million.

From one perspective, because Bristol Bay fishing and processing occurs in Alaska, all of this output value was created in Alaska. From a different perspective, however, it was created in the states that provided the fishermen, processing workers, supplies and services that created the value. Both perspectives are useful. For the purposes of this study, we adopted the second perspective, and allocated output value to the states to which estimated payments from output value were made—a measure of their contribution to output value.

Note that defined in this way, Washington contributed the greatest share of output value, primarily because of its contributions to the value created in processing. Although Bristol Bay salmon processing takes place in Alaska, it is (from our second perspective) more a Washington industry than an Alaska industry—because all of the large processing companies are based in Washington, such a large share of their supplies and services are purchased from Washington, and many of the fishermen are from Washington.

Figure IV-3



V. MULTIPLIER ECONOMIC IMPACTS OF BRISTOL BAY SALMON FISHING AND PROCESSING

The multiplier economic impacts of Bristol Bay salmon fishing and processing are the indirect and induced impacts on other industries driven by payments of fishermen and processors to businesses and households. This chapter describes our estimates of multiplier economic impacts. Appendix B provides technical details of how we estimated them and sources for all of the data and estimates in this chapter.

Estimated Payments of Bristol Bay Fishermen and Processors

In 2010, Bristol Bay salmon processors were paid $390 million for the salmon products they produced in the Bristol Bay fishery. Estimating the payments from this value, and what states they went to, was the first step in our analysis of multiplier impacts. Table V-1 summarizes these estimates, which we based on State of Alaska data for processing workers' and permit holders' earnings, earlier studies of permit holders' costs, discussions with industry sources, and our best judgment.

Table V-1

Assumed Direct Payments from Bristol Bay Fishing and Processing, by State, 2010 ($ millions)

		Payments by State				
	Total	AK	WA	OR	CA	Other
Total first wholesale value FOB Bristol Bay (a)	389.7					
Value added in Bristol Bay by processors (a)	224.5					
Ex-vessel value paid to permit holders (a)	165.2					
Payments by processors (b)	**224.5**	**43.4**	**142.9**	**6.3**	**12.6**	**19.4**
Labor	34.0	3.9	9.0	1.5	12.6	6.9
Tendering	31.5	6.3	22.1	3.2		
Maintenance	29.2	2.9	26.3			
Packaging	23.3	0.0	14.0			9.3
Fishermen's support services	18.1	5.4	11.1	1.6		
Variable supplies	10.5	2.1	7.4			1.1
State & local taxes	9.9	9.9				
Fuel	7.4	1.9	5.6			
Utilities	7.0	7.0				
Insurance	5.4	0.0	5.4			
Food	4.7	0.5	4.2			
Air travel	4.7	0.2	4.4			
Fixed supplies	3.5	0.4	2.8			0.4
Rents & leases	1.2	1.2				
Other payments and returns to investment	34.1	1.7	30.7			
Payments by permit-holders (c)	**165.2**	**83.3**	**55.6**	**7.2**	**6.8**	**12.3**
Crew shares (excluding skipper)	37.1	15.5	13.4	2.2	2.1	3.8
Maintenance (routine & unexpected)	7.6	6.3	1.3			
Nets (hanging, repair, and web)	6.4	5.3	1.1			
Vessel and gear replacement	6.1	0.5	5.6			
Insurance (P&I, hull, lay-up)	5.2	2.0	2.7	0.2	0.2	0.3
Fuel, oil, & lubricants	5.1	5.1				
Miscellaneous gear & supplies	5.0	2.9	2.1			
Transportation	4.9	2.2	1.7	0.3	0.3	0.4
Raw fish tax	4.8	4.8				
Food	4.1	2.7	1.4			
Moorage, storage, and haul-out	3.0	3.0				
Administrative services	1.7	0.7	0.6	0.1	0.1	0.2
Property tax	0.7	0.7				
Annual permit fee	0.6	0.6				
Annual vessel license fee	0.2	0.2				
Retained by permit holders (d)	72.7	30.8	25.8	4.4	4.2	7.6

(a) Estimated direct output value reported in Table IV-5.

(b) Payments from value added in Bristol Bay by processors, excluding payments to permit holders for fish.

(c) Payments from ex-vessel value paid to permit holders.

(d) Returns to permit holders' labor, management and investment

Figures V-1 and V-2 show how the amounts and composition of payments differed between states. Washington received the largest share of the payments, primarily because most processing costs and processors' returns to investment went to Washington. Alaska received the second largest share of the payments, mostly for fishing crew, other fishing costs, permit holder net earnings, and processing costs.

Figure V-1

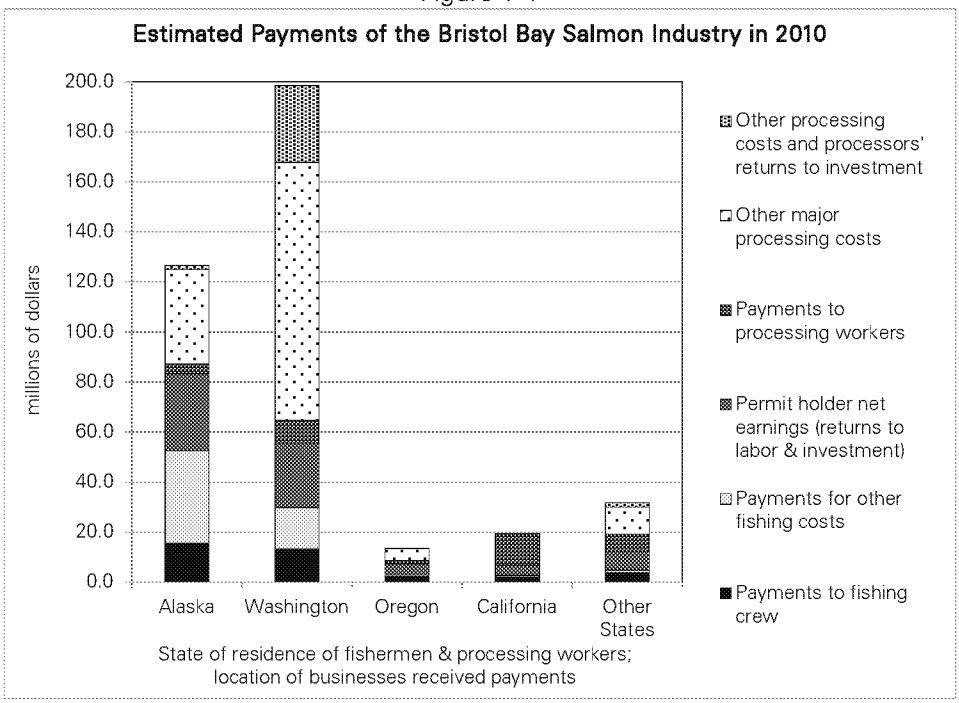
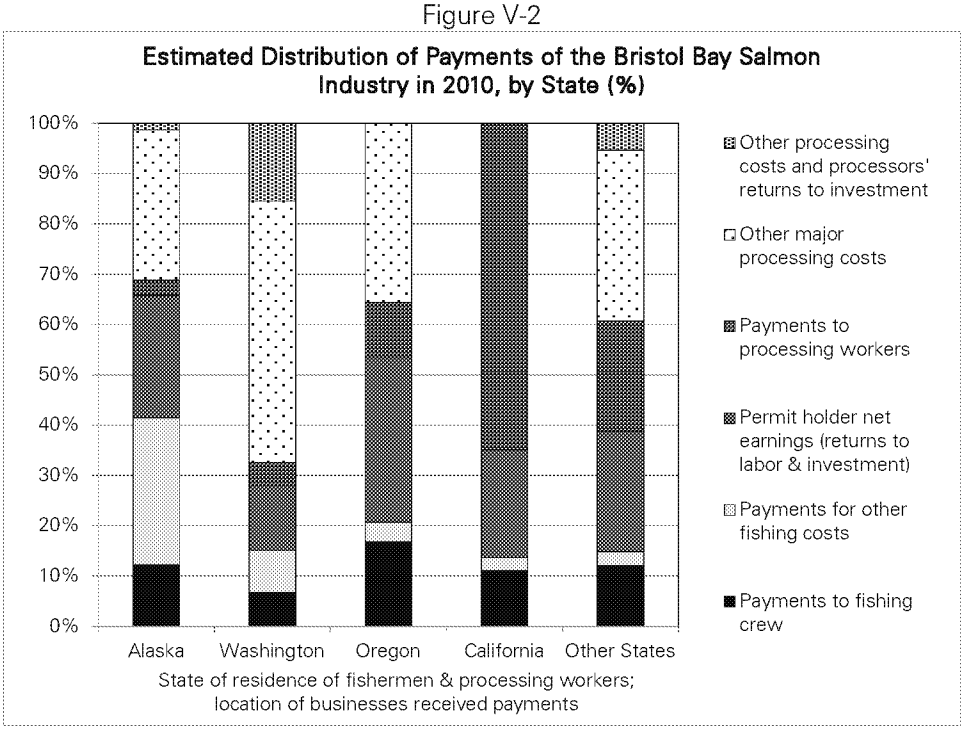


Figure V-2



The estimates of payments by state shown in Figure V-1 are among the most important analysis and findings of this report, because it is these payments which drive the multiplier impacts of Bristol Bay fishing and processing. The fact that such a large share of the payments from fishing and processing goes to Washington helps to explain why the economic impacts of the Bristol Bay salmon fishery are so large and important for Washington.

Estimated Multiplier Impacts of Bristol Bay Fishing and Processing

We used IMPLAN input-output models to estimate the multiplier economic impacts (indirect and induced impacts) resulting from payments to different states to calculate the multiplier economic impacts of Bristol Bay salmon fishing and processing in the United States and in the four west coast states. Table V-2 and Figures V-3 through V-5 summarize these estimates.

Table V-2
Estimated Economic Impacts of Bristol Bay Salmon Fishing and Processing, 2010

Measure	Type of impact	Total US	Alaska	Washington	Oregon	California	Other states
Annual average employment	Direct impact	1,987	728	538	92	357	271
	Indirect impact	2,370	761	1,212	57	4	336
	Induced impact	3,482	578	1,025	106	245	1,529
	Multiplier impact	5,852	1,338	2,237	163	249	1,865
	Total impact	7,839	2,067	2,775	255	606	2,137
Income ($ millions)	Direct impact	143.7	50.1	48.2	8.1	18.9	18.4
	Indirect impact	111.6	38.0	54.0	2.7	0.3	16.7
	Induced impact	156.4	24.0	43.7	4.0	11.9	72.9
	Multiplier impact	268.0	62.0	97.6	6.7	12.1	89.6
	Total impact	411.7	112.1	145.8	14.8	31.0	108.0
Output value ($ millions)	Direct impact	389.7	126.7	198.5	13.4	19.4	31.7
	Indirect impact	310.7	88.4	155.5	7.1	0.7	58.9
	Induced impact	490.5	72.6	132.2	11.7	35.8	238.2
	Multiplier impact	801.2	161.0	287.8	18.9	36.5	297.0
	Total impact	1190.9	287.7	486.3	32.3	55.9	328.7

We estimated that, for the United States nationally, Bristol Bay salmon fishing and processing generated multiplier impacts in other industries totaling 5800 jobs (annual average employment), $268 million in income, and $801 million in output value. The distribution of multiplier impacts between states was similar to the distribution of the spending which drove the multiplier impacts (Figure V-1). The multiplier impacts were greatest in Washington (more than one-third of total multiplier impacts), followed by Alaska (about one-fourth).

Appendix C

Figure V-3

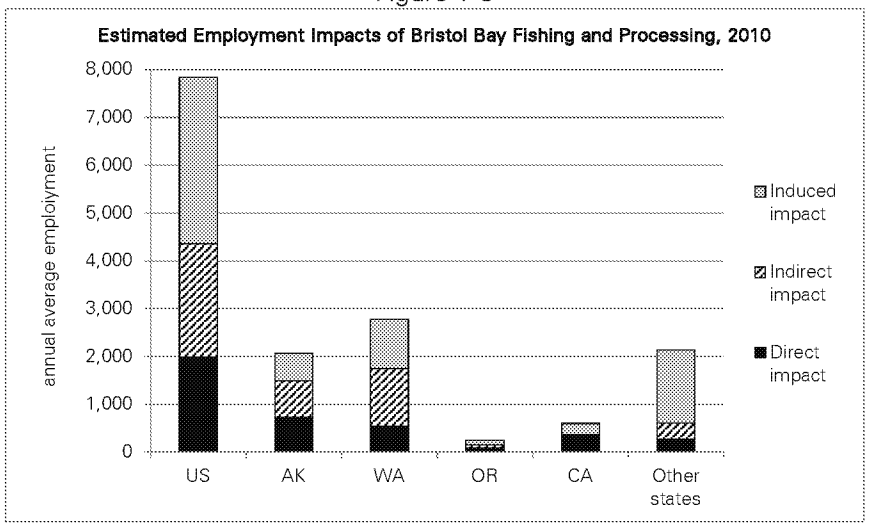


Figure V-4

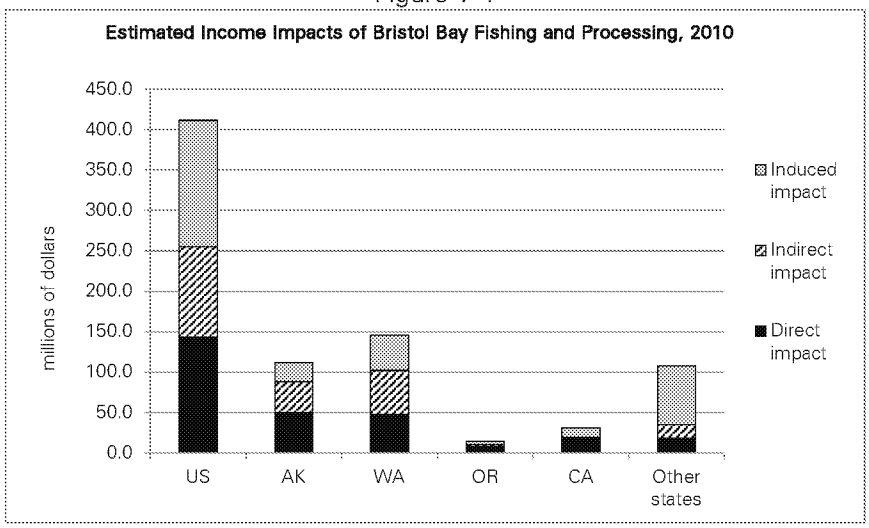
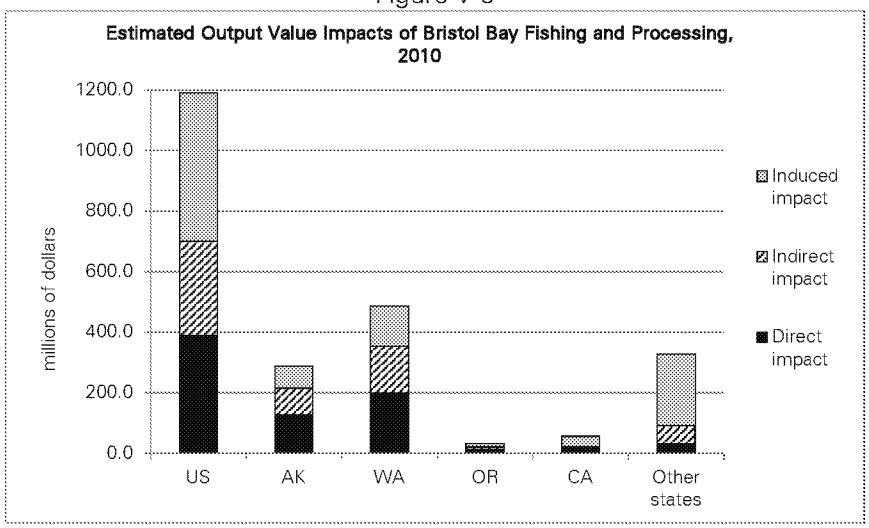


Figure V-5



Economic Multipliers for Bristol Bay Fishing and Processing

Economists use the term "multiplier" to refer to the ratio of indirect, induced, or multiplier (indirect + induced) output value impacts to direct output value impacts. The output value multipliers show how much indirect, induced or multiplier (indirect + induced) output value is created in the economy for every dollar of direct output value.

Table V-3 shows the output value multipliers for Bristol Bay salmon fishing and processing implied by our economic impact analysis for 2010. Looking at the bottom row, every dollar of direct output value in Bristol Bay salmon fishing and processing created an estimated additional $2.06 in multiplier impacts. The output value multipliers are highest for the United States and lowest for Alaska. This is because the output value multipliers measure the additional output value created as payments ripple through the economy. In general, the larger an economy, the greater this ripple effect of payment flows within the economy.

The output value multipliers are smallest for Alaska because a greater share of the payments of businesses and households in Alaska go outside the state than in than in larger states or for the United States as a whole.

Table V-3

Estimated Output Value Multipliers for Bristol Bay Salmon Fishing and Processing, 2010

Multiplier	US	AK	WA	OR	CA
Ratio of indirect impacts to direct impacts	0.80	0.70	0.78	0.53	0.04
Ratio of induced impacts to direct impacts	1.26	0.57	0.67	0.87	1.85
Ratio of multiplier impacts to direct impacts	2.06	1.27	1.45	1.41	1.88

Figure V-3

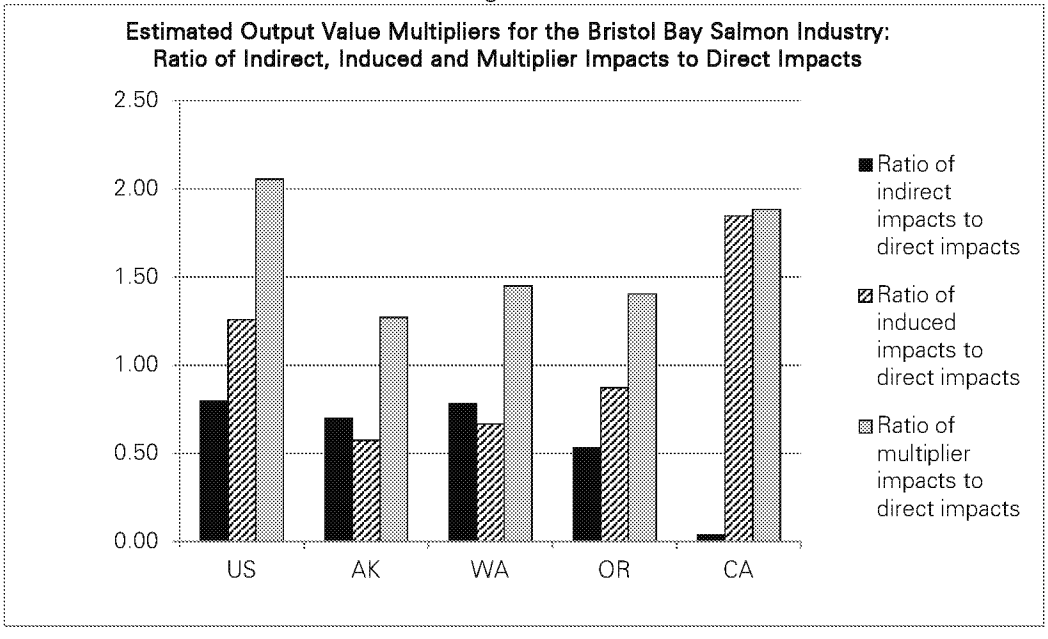


Table V-4 shows the ratio of nationwide (total US) multiplier employment to direct employment in Bristol Bay salmon fishing and processing. For every direct job created by the Bristol Bay salmon fishing and processing, almost three multiplier jobs are created in other industries across the United States.

Table V-4
Ratio of Nationwide Multiplier Employment to Direct Employment
in Bristol Bay Salmon Fishing & Processing, 2010

Type of impact	Ratio
Ratio of indirect impacts to direct impacts	1.19
Ratio of induced impacts to direct impacts	1.75
Ratio of multiplier impacts to direct impacts	2.95

Helicopter transportation to Bristol Bay floating processors
Is a multiplier impact of Bristol Bay salmon processing

VI. SELECTED DOWNSTREAM ECONOMIC IMPACTS OF THE BRISTOL BAY SALMON INDUSTRY

The downstream economic impacts of the Bristol Bay salmon industry are those driven by the transportation, secondary processing, warehousing, distribution and retailing of Bristol Bay salmon which occurs in the United States. For this study, we estimated the following downstream economic impacts:

- *Shipping to other states and secondary processing:* We estimated economic impacts of marine transportation of frozen and canned salmon, secondary processing of frozen salmon, and warehousing and labeling of canned salmon for the United States, Washington and Oregon.

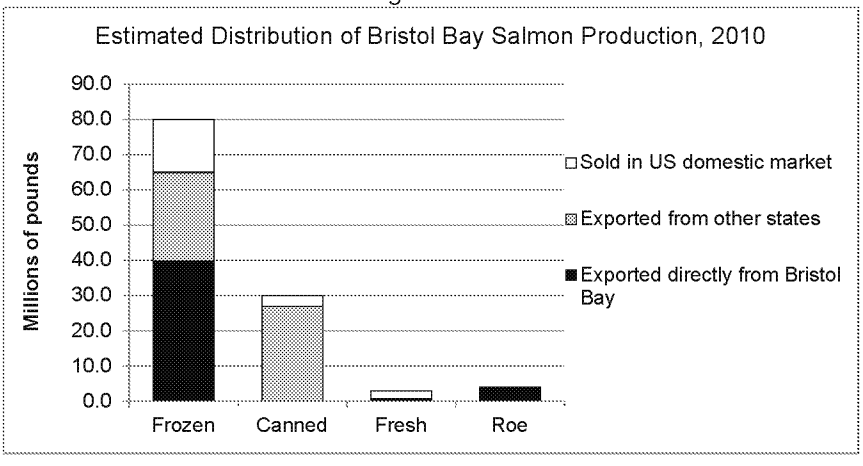
- *Distribution and retailing:* We estimated economic contributions of nationwide transportation, wholesaling and retailing of Bristol Bay salmon products in stores and restaurants.

This chapter discusses our estimates of downstream economic impacts. Appendix C provides technical details of how we estimated them, as well as sources for the data and estimates of economic impacts in this chapter. Appendix E discusses the estimates presented in this chapter of Bristol Bay salmon export value and United States consumption of frozen salmon.

End Markets for Bristol Bay Salmon Products

The first step in our analysis of downstream economic impacts of the Bristol Bay salmon industry was to estimate end markets for Bristol Bay salmon. In 2010, about half of Bristol Bay frozen salmon was exported directly from Bristol Bay, primarily to Japan and China. We assumed the rest was shipped to Washington for secondary processing, including filleting, portioning, re-boxing and smoking. About three-fifths of these products were also exported. The rest—about one-fifth of total Bristol Bay frozen salmon production—was sold in the US market.

Figure VI-1



All Bristol Bay canned salmon is shipped to warehouses in Washington and Oregon where it is stored, labeled and sold by processors over the course of the year, mostly to the United Kingdom and other export markets. We assumed that most of the small volume of Bristol Bay fresh salmon is sold in the

United States, and that all of the roe production is exported. Overall, about 83% of the total volume of Bristol Bay salmon production (all products combined) is exported, and about 17% is sold in the United States market.

Table VI-1

Assumed End-Markets for Bristol Bay Salmon Production, 2010

		Frozen	Canned	Fresh	Roe	Total
Millions of pounds	Total production	80.0	29.9	2.9	4.0	116.7
	Exported directly from Bristol Bay	39.8	0.0	0.5	4.0	44.3
	Shipped to other states	**40.2**	**29.9**	**2.4**	**0.0**	**72.4**
	Exported from other states	25.2	26.9	0.2	0.0	52.2
	Sold in US domestic market	**15.0**	**3.0**	**2.2**	**0.0**	**20.2**
Share of production	Total production	100%	100%	100%	100%	100%
	Exported directly from Bristol Bay	50%	0%	19%	100%	38%
	Shipped to other states	**50%**	**100%**	**81%**	**0%**	**62%**
	Exported from other states	31%	90%	6%	0%	45%
	Sold in US domestic market	**19%**	**10%**	**76%**	**0%**	**17%**
Other assumptions	Mode of transportation to other states	Sea	Sea	Air		
	Assumed states to which products were initially shipped	100% to Washington	50% to Washington 50% to Oregon			
	Types of secondary processing and other handling prior to distribution to retailers	Filleting, portioning, reboxing, smoking	Warehousing & labeling			

Sources: Alaska production data, US export data, and discussions with industry sources, as discussed in Appendix C.

Until the late 1990s, almost all Bristol Bay frozen salmon was exported, mostly to Japan. Since then, although the share of Bristol Bay frozen salmon sold in the United States market remains relatively small, it has been gradually rising over time (Figure VI-2). Factors contributing to the growth in the domestic market for Bristol Bay sockeye have included the development of new product forms, particularly fillets and portions, and sustained and effective marketing by Alaska processors and the Alaska Seafood Marketing Institute (ASMI). As these continue, it is likely that the share of Bristol Bay salmon consumed by Americans will continue to grow—increasing the downstream economic impacts and contributions of Bristol Bay salmon.

Downstream jobs supported partly by Bristol Bay salmon

Forklift operator at Salmon Terminals canned salmon warehouse, Auburn, Washington

Retail fish counter employee

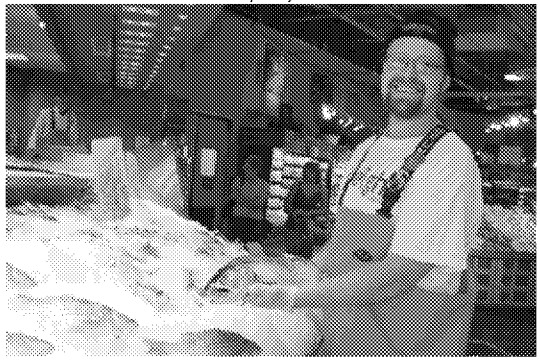
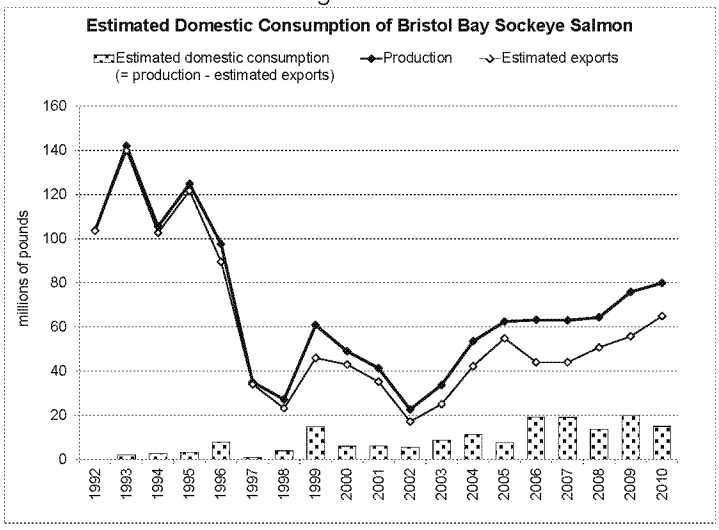
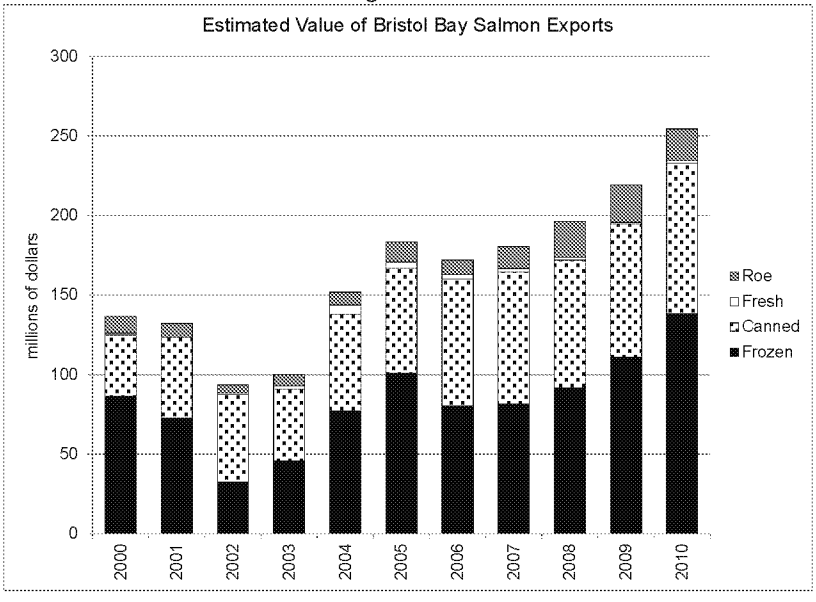


Figure VI-2



As shown in Figure VI-3, the estimated value of Bristol Bay salmon exports has risen dramatically since 2002 as prices for Bristol Bay sockeye salmon have risen. In 2010, the estimated total value of Bristol Bay salmon exports was $252 million, or approximately 74% of the value of total US sockeye salmon exports, 28% of the value of total US salmon exports (all species), and 6% of the value of total US edible fish exports (all species).

Figure VI-3



The high export share of Bristol Bay sockeye salmon reduces its downstream economic contribution in domestic distribution and retailing. But Bristol Bay salmon exports are economically important to the United States in a different way: they contribute to the United States balance of trade, helping to maintain the value of the dollar and pay for imports. In particular, they help to offset the United States' massive seafood trade deficit (US seafood imports in 2010 totaled $14.8 billion compared with total exports of $4.4 billion).

Downstream Increases in Value of Bristol Bay Salmon

The economic impacts of the Bristol Bay salmon industry are driven by the payments associated with each distribution chain stage which go to businesses and to households (as payments to workers and profits of owners). Collectively these payments are equal to the increase in value associated with each stage. Figure VI-4 and Table VI-2 show our estimates of these increases in value.

Figure VI-4

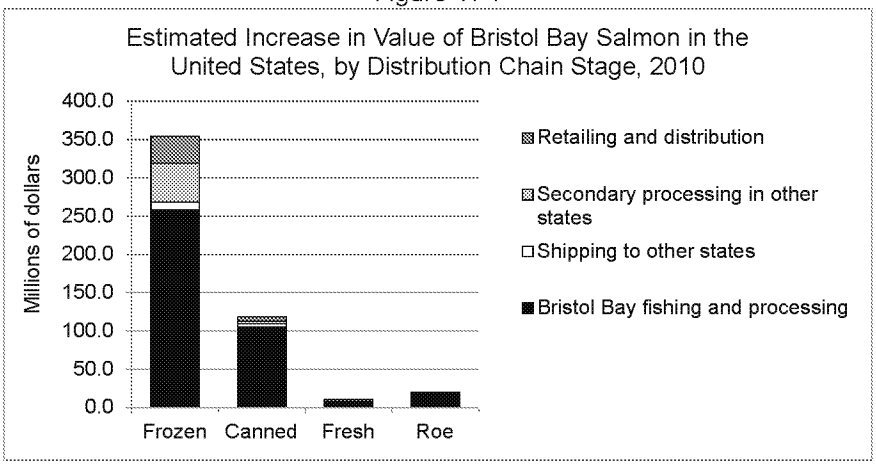


Table VI-2

Estimated Increase in Value of Bristol Bay Salmon in the United States, by Distribution Chain Stage, 2010

	Distribution chain stage	Primary product form				Total
		Frozen	Canned	Fresh	Roe	
Product volume entering stage (millions of lbs, primary product weight basis)	Bristol Bay fishing and processing	80.0	29.9	2.9	4.0	116.7
	Shipping to other states	40.2	29.9	2.9		72.4
	Secondary processing in other states	40.2	29.9			70.1
	Retailing and distribution	15.0	3.0	2.2		20.2
Increase in value/lb in stage (primary product weight basis)	Bristol Bay fishing and processing (= first wholesale price)	$3.23	$3.52	$2.11	$5.03	
	Shipping to other states	$0.26	$0.13	$0.50		
	Secondary processing in other states	$1.25	$0.10			
	Retailing and distribution	$2.37	$1.88			
Increase in value in stage ($ millions)	Bristol Bay fishing and processing	258.3	105.4	6.1	19.9	389.7
	Shipping to other states	10.4	4.0	1.4		15.9
	Secondary processing in other states	50.4	3.1			53.5
	Retailing and distribution	35.6	5.6	2.9		44.1
	Total	**354.7**	**118.1**	**10.4**	**19.9**	**503.1**
Share of total increase in value	Bristol Bay fishing and processing	73%	89%	59%	100%	77%
	Shipping to other states	3%	3%	14%	0%	3%
	Secondary processing in other states	14%	3%	0%	0%	11%
	Retailing and distribution	10%	5%	27%	0%	9%
	Total	**100%**	**100%**	**100%**	**100%**	**100%**

Note that 77% of the total estimated increase in value—and the corresponding payments—occurs in Bristol Bay fishing and processing. Only about 23% of the estimated increase in value occurs in downstream stages of the distribution chain. For this reason, the estimated downstream economic impacts and contribution are much smaller than the estimated economic impacts of Bristol Bay salmon fishing and processing.

Estimated Downstream Economic Impacts of Marine Transportation and Secondary Processing

Table VI-3 summarizes the estimated payments generated in marine transportation and selected secondary processing activities of Bristol Bay sockeye salmon in 2010. The largest of these are in secondary processing of frozen salmon, mostly in Washington.

Table VI-3
Estimated Payments Generated in Selected Shipping and Secondary Processing, 2010 ($ millions)

Activity	US	WA	OR
Marine transportation of frozen salmon	10.4	10.4	
Frozen salmon secondary processing	50.4	42.2	
Marine transportation of canned salmon	4.0	2.0	2.0
Canned salmon warehousing and labeling	3.1	1.6	1.6
Total	67.9	56.1	3.5

We used IMPLAN input-output models to estimate the multiplier economic impacts (indirect and induced impacts) resulting from these estimated payments in the United States, Washington and Oregon. Table VI-4 summarizes these estimates.

Table VI-4
Estimated Downstream Economic Impacts of Selected Shipping and Secondary Processing, 2010

Measure	Type of impact	Total US	Washington	Oregon
Annual average employment	Direct effect	191	156	15
	Indirect effect	243	103	12
	Induced effect	319	126	12
	Multiplier effect	563	229	24
	Total effect	754	385	39
Income ($ millions)	Direct effect	13.1	11.0	0.9
	Indirect effect	15.8	6.3	0.5
	Induced effect	14.3	5.4	0.4
	Multiplier effect	30.1	11.7	1.0
	Total effect	43.2	22.7	1.8
Output value ($ millions)	Direct effect	67.8	56.0	3.5
	Indirect effect	66.2	21.1	1.3
	Induced effect	44.8	16.3	1.3
	Multiplier effect	111.0	37.4	2.6
	Total effect	178.8	93.5	6.2

Estimated Downstream Economic Contributions of Distribution and Retailing of Bristol Bay Sockeye Salmon Products

Table VI-5 summarizes the estimated payments generated by nationwide distribution and retailing of Bristol Bay salmon products in 2010. Recall, as discussed in Chapter III, that these estimates are based on the simple and conservative assumption that distribution and retailing increases the value of Bristol Bay salmon products by an average of 50%.

Table IV-5

Estimated Payments Generated in Nationwide Distribution and Retailing of Bristol Bay Salmon Products, 2010 ($ millions)

Activity	US
Distribution & retailing of frozen salmon	35.6
Distribution & retailing of canned salmon	5.6
Air transportation of fresh salmon	1.4
Distribution & retailing of fresh salmon	2.9

We used the national IMPLAN input-output model to estimate the multiplier economic contributions (indirect and induced contribution) resulting from these estimated payments. Table IV-6 summarizes these estimates. They should be interpreted as estimates of *what the associated jobs, income and output value would have been if the average increase in value were 50%*, rather than as a precise estimate of what they were. It is likely that the actual economic contributions associated with distribution and retailing in 2010 were at least as high as our estimates, and possible that they were significantly higher. Recall that these are estimated economic *contributions* rather than impacts, because not all of the economic activity currently associated with distribution and retailing Bristol Bay sockeye salmon would necessarily disappear if Bristol Bay salmon didn't exist–because consumers would buy more of other kinds of fish and other products if they couldn't buy Bristol Bay salmon.

Table IV-6

Estimated Downstream Economic Contributions of Distribution and Retailing of Bristol Bay Salmon Products in the United States, 2010

Measure	Type of contribution	Activity
Annual average employment	Direct contribution	787
	Indirect contribution	112
	Induced contribution	312
	Multiplier contribution	425
	Total contribution	1,212
Income ($ millions)	Direct contribution	22.7
	Indirect contribution	5.6
	Induced contribution	14.0
	Multiplier contribution	19.6
	Total contribution	42.3
Output value ($ millions)	Direct contribution	45.5
	Indirect contribution	16.9
	Induced contribution	43.8
	Multiplier contribution	60.8
	Total contribution	106.3

VIII. CONCLUSIONS

The Bristol Bay sockeye salmon fishery is the world's most valuable wild salmon fishery, and typically supplies almost half of the world's wild sockeye salmon. In 2010, Bristol Bay salmon fishermen harvested 29 million sockeye salmon worth $165 million in direct harvest value alone. That represented 35% of the total Alaska salmon harvest value, and was greater than the total value of fish harvests in 41 states. Salmon processing in Bristol Bay increased the value by $225 million to a total first wholesale value after processing of $390 million. The total value of Bristol Bay salmon product exports in 2010 was about $250 million, or about 6% of the total value of all U.S. seafood exports.

In 2010, Bristol Bay salmon fishing and processing and its downstream and multiplier impacts created annual average employment of almost 10,000, more than $500 million in income, and $1.5 billion in output value in the United States. The figures and tables at the end of this chapter provide details of our estimates of the direct and multiplier impacts and contributions of the Bristol Bay salmon industry in 2010.

During the 2010 salmon season, almost 12,000 people worked in Bristol Bay salmon fishing and processing. About 7,000 worked in fishing and almost 5,000 worked in processing.

The economic importance of the Bristol Bay salmon industry goes well beyond the jobs, income and output value created by the fishing and processing which happens in Bristol Bay. More jobs, income and output value are created in other industries as Bristol Bay fishermen and processors purchase supplies and services and spend the money they earn. Still more jobs, income and output value are created in downstream industries as Bristol Bay salmon are shipped to other states, undergo further processing, and are sold in stores and restaurants across the United States.

Although Bristol Bay fishing and processing take place in Alaska, about four-fifths of the economic impacts and contributions occur outside Alaska; about one-third occur in Washington. This is because almost two-thirds of the people working in Bristol Bay are from other states; the major processors are all based in Washington; most of the supplies and services are purchased from Washington; most of the multiplier or ripple effects occur in other states; and downstream economic impacts occur in other states, and are concentrated in Washington.

Because most of the total economic impacts of the Bristol Bay salmon industry occur outside Alaska, previous studies which focused only on impacts which occur in Alaska greatly understated its national economic importance. It is natural and reasonable for economic studies done by and for Alaskans to focus on the economic importance of the industry for Alaska. But from a national perspective, it is the national economic impacts which matter.

Multiplier economic impacts of Bristol Bay fishing and processing account for the largest share of the total economic impacts of the Bristol Bay salmon industry. For every dollar of direct output value created in Bristol Bay fishing and processing, more than two additional dollars of output value are created in other industries, as payments from the Bristol Bay fishery ripple through the economy. These payments create almost three jobs for every direct job in Bristol Bay fishing and processing.

The downstream economic impacts of the Bristol Bay salmon industry currently represent less than one-fifth of the total impacts. This is because only about 17% of Bristol Bay salmon is consumed in the United States: almost two-fifths is exported directly from Bristol Bay and another two-fifths is exported from other states.

The downstream economic impacts of Bristol Bay sockeye salmon are likely to grow over time. United States domestic consumption of Bristol Bay frozen sockeye salmon products has been growing—and is likely to continue to grow—as a result of sustained and effective marketing by the industry, new product development and other factors.

Exports of Bristol Bay salmon benefit the United States economy. They contribute to the United States balance of trade, helping to maintain the value of the dollar and pay for imports. In particular, they help to offset the United States' massive seafood trade deficit.

What matters in this report are not the specific estimates of economic impacts for 2010, but their relative scale and distribution. Future economic impacts of the Bristol Bay salmon industry will vary from year to year with catches and prices, but will remain similar in relative scale and distribution among states and stages of the distribution chain to those we estimated in this report.

The economic importance of the Bristol Bay salmon industry goes beyond the economic impacts and contributions which we estimated for this report. The Bristol Bay salmon industry is a major part of the broader Alaska and Pacific Northwest seafood industry, and pays for an important share of the fixed costs of many fishing and processing operations. Without the Bristol Bay salmon industry, fixed costs would be higher and profits lower in the rest of the seafood industry. The Bristol Bay salmon industry is a major supporter of infrastructure and utilities in the Bristol Bay region, a major taxpayer, and a very important source of local jobs and income.

Appendix C

Figure VIII-1

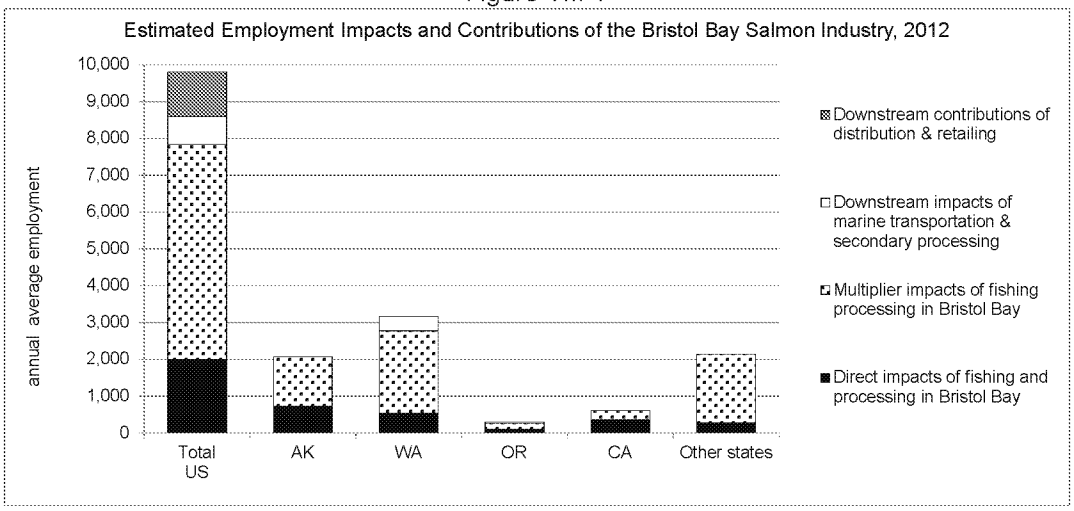


Figure VIII-2

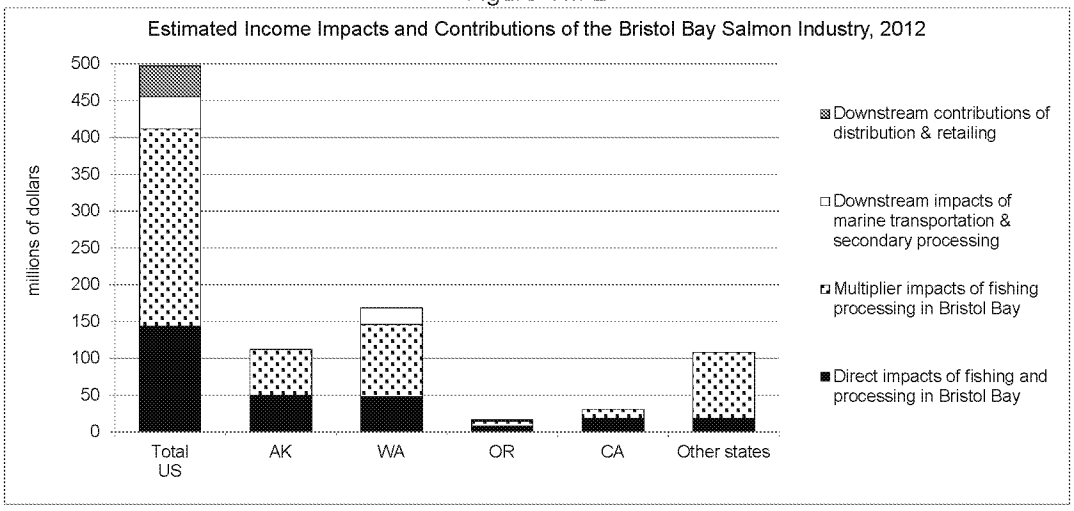


Figure VIII-3

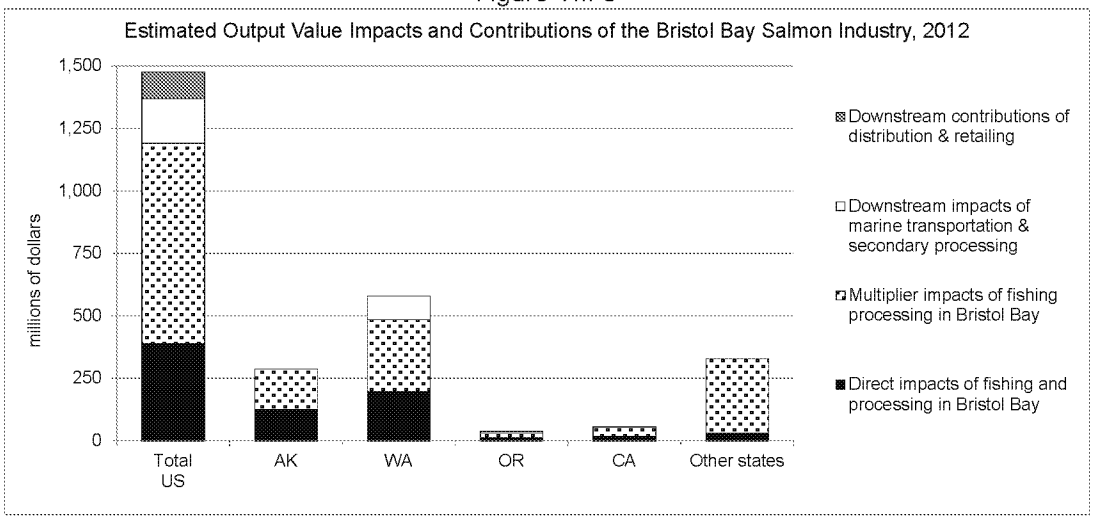


Table VIII-1

Estimated Employment Impacts and Contributions of the Bristol Bay Salmon Industry, 2010 (annual average employment)

Impact Driver		Total US	AK	WA	OR	CA	Other states
Fishing and primary processing in Bristol Bay	Direct impacts*	1,987	728	538	92	357	271
	Multiplier impacts	5,852	1,338	2,237	163	249	1,865
	Total impacts	**7,839**	**2,067**	**2,775**	**255**	**606**	**2,137**
Marine transportation & secondary processing	Direct impacts	191		156	15		
	Multiplier impacts	563		229	24		
	Total impacts	**754**		**385**	**39**		
Total impacts		**8,592**		**3,160**	**294**		
Nationwide distribution and retailing	Direct contributions	787					
	Multiplier contributions	425					
	Total contributions	**1,212**					
Total impacts & contributions		**9,804**					

Table VIII-2

Estimated Income Impacts and Contributions of the Bristol Bay Salmon Industry, 2010 (millions of dollars)

Impact Driver		US	AK	WA	OR	CA	Other states
Fishing and primary processing in Bristol Bay	Direct impacts	144	50	48	8	19	18
	Multiplier impacts	268	62	98	7	12	90
	Total impacts	**412**	**112**	**146**	**15**	**31**	**108**
Marine transportation & secondary processing	Direct impacts	13		11	1		
	Multiplier impacts	30		12	1		
	Total impacts	**43**		**23**	**2**		
Total impacts		**455**		**169**	**17**		
Nationwide distribution and retailing	Direct contributions	23					
	Multiplier contributions	20					
	Total contributions	**42**					
Total impacts & contributions		**497**					

Table VIII-3

Estimated Output Value Impacts and Contributions of the Bristol Bay Salmon Industry, 2010 (millions of dollars)

Impact Driver		US	AK	WA	OR	CA	Other states
Fishing and primary processing in Bristol Bay	Direct impacts	390	127	198	13	19	32
	Multiplier impacts	801	161	288	19	37	297
	Total impacts	**1,191**	**288**	**486**	**32**	**56**	**329**
Marine transportation & secondary processing	Direct impacts	68		56	4		
	Multiplier impacts	111		37	3		
	Total impacts	**179**		**93**	**6**		
Total impacts		**1,370**		**580**	**38**		
Nationwide distribution and retailing	Direct contributions	46					
	Multiplier contributions	61					
	Total contributions	**106**					
Total impacts & contributions		**1,476**					

APPENDIX A:
ESTIMATION OF DIRECT ECONOMIC IMPACTS OF BRISTOL BAY SALMON FISHING AND PROCESSING

The direct economic impacts of Bristol Bay salmon fishing and processing are the employment, income and output value created in Bristol Bay every summer in the fishing and processing industries. Table A-1 summarizes our estimates of these direct economic impacts. This appendix discusses how we developed these estimates.

Table A-1
Estimated Direct Economic Impacts of Bristol Bay Salmon Fishing and Processing, 2010

	Total US	AK	WA	OR	CA	Other states
Seasonal employment	11,921	4,369	3,227	553	2,143	1,629
Annual average employment	1,987	728	538	92	357	271
Income ($ million)	143.7	50.1	48.2	8.1	18.9	18.4
Output value ($ million)	389.7	126.7	198.5	13.4	19.4	31.7

Sources: See discussion in Appendix A. Note: Direct employment and income impacts are allocated to the states in which workers are residents; direct output value impacts are allocated to the states to which payments from total output value are made (including wage payments).

Challenges in Measuring Bristol Bay Salmon Industry Employment

Measuring employment in the Bristol Bay salmon industry is complicated by several factors. First, no employment data are collected for commercial fishing comparable to the employment data collected for most other industries. This is because commercial fishermen (both permit holders and crew) are considered self-employed, and they do not pay unemployment insurance. Employment data for most industries (including fish processing) are based on unemployment insurance reporting forms filed by employers. To make up for this significant gap in Alaska employment data, the Alaska Department of Labor and Workforce Development (ADLWD) Research and Analysis Division estimates monthly commercial fishing employment by multiplying the number of permits for which fish landings are reported each month by assumed average employment per permit fished (crew factors).

Second, the Bristol Bay salmon industry is highly seasonal. Most of the fishing and processing occurs between the middle of June and the middle of July, with smaller numbers of fishermen and processing workers engaged in smaller-scale fishing and processing as well as start-up and close-down activities earlier and later in the year. Thus a Bristol Bay fishing or processing job which typically lasts about two months is not directly comparable to a year-round job in another industry. To provide a basis for comparing employment in the Bristol Bay salmon industry with year-round employment in other industries, we estimate "annual average employment," calculated as the total number of months worked divided by 12.

Third, the "Bristol Bay Region" for which ADLWD reports fish processing employment and estimated salmon fishing employment includes the Chignik salmon fishery—an important Alaska salmon fishery although much smaller than the Bristol Bay fishery. By way of comparison, between 2006 and 2010,

expressed as a percentage of the Bristol Bay salmon fisheries, total pounds landed in the Chignik salmon fishery were 7.7% of Bristol Bay, earnings were 6.3% of Bristol Bay, and total permits fished were 2.4% of Bristol Bay. Thus ADLWD fish harvesting and processing employment estimates and data for the "Bristol Bay region" slightly overestimate employment for the Bristol Bay salmon fishery.

Fourth, estimates of fish processing employment are not available by fishery—because in reporting employment fish processing plants do not distinguish between the species of fish that their workers were processing during the reporting period. Thus fish processing employment estimates for the Bristol Bay region include some employment in processing other species such as herring. However, it is likely that fish processing employment data for the Bristol Bay region are overwhelmingly dominated by Bristol Bay salmon. For a comparison of the relative scale of the two fisheries, between 2006 and 2010, expressed as a percentage of the Bristol Bay salmon fisheries, total pounds landed in the Bristol Bay (Togiak) herring seine and gillnet fisheries were 22.6% of pounds landed in the Bristol Bay salmon fisheries, earnings were 2.1% of earnings in the salmon fisheries, and the total permits fished were 2.6% of permits fished in the salmon fisheries (CFEC Basic Information Tables). Note also that Bristol Bay herring processing is much less labor intensive than salmon processing because Bristol Bay herring are entirely frozen round for export.

Estimation of Direct Employment Impacts

The direct employment impacts of Bristol Bay salmon and fishing are the seasonal jobs created every summer in Bristol Bay. The starting point for our estimates of direct employment impacts were the data shown in Tables A-2 and A-3 below. Table A-2 shows Alaska Department of Labor and Workforce Development (ADLWD) estimates of Bristol Bay salmon harvesting and processing employment and wages in 2010. Note that the harvesting employment estimate of 7035 is are for the peak harvesting employment month of July (by way of comparison, estimated 2010 Bristol Bay salmon harvesting employment was 6573 for June, 1065 for August, 68 for September, and 0 for all other months).

Table A-2

Alaska Department of Labor and Workforce Development Estimates of Bristol Bay Salmon Fishing and Processing Employment and Wages, 2010

Estimated salmon harvesting employment, July	7035
Bristol Bay region seafood processing total worker count	4886
Bristol Bay region seafood processing percent nonresident workers	87.0%
Bristol Bay region seafood processing wages	$33,963,492
Bristol Bay region percent nonresident wages	88.5%

Sources: ADLWD Bristol Bay Region Fishing Employment Estimates; ADLWD Bristol Bay Region Seafood Processing Employment and Earnings Data.

Table A-3 shows Commercial Fisheries Entry Commission (CFEC) 2010 data for Bristol Bay limited entry permit holders, pounds landed, and estimated gross earnings by state. These data are the basis for much of our estimation of economic impacts of Bristol Bay *fishing* by state. Note that while Alaska accounted for 53.1% of Bristol Bay permit holders, it accounted for only 41.8% of gross earnings—partly because Alaskans had lower average gross earnings in both fisheries, and partly because Alaskans accounted for a relatively higher share of permits in the set gillnet fishery, in which average earnings are lower than for the drift gillnet fishery. In contrast, Washington accounted for only 27.7% of permits but for 36.0% of gross earnings.

Table A-3

Bristol Bay Limited Entry Permit Holders, Pounds Landed, and Estimated Gross Earnings, by State, 2010

	Fishery	Total	Alaska	Washington	Oregon	California	Other
Number of permit holders	Drift	1,850	845	642	98	109	156
	Set	927	629	127	38	34	99
	Total	2,777	1,474	769	136	143	255
	% of total	100.0%	53.1%	27.7%	4.9%	5.1%	9.2%
Number of permits issued	Drift	1,863	854	644	98	110	157
	Set	982	665	135	39	37	106
	Total	2,845	1,519	779	137	147	263
	% of total	100.0%	53.4%	27.4%	4.8%	5.2%	9.2%
Number of fishermen who fished	Drift	1,510	660	538	87	87	138
	Set	816	535	118	39	32	92
	Total	2,326	1,195	656	126	119	230
	% of total	100.0%	51.4%	28.2%	5.4%	5.1%	9.9%
Number of permits fished	Drift	1,494	650	538	87	87	138
	Set	861	566	124	40	35	100
	Total	2,355	1,216	662	127	122	238
	% of total	100.0%	51.6%	28.1%	5.4%	5.2%	10.1%
Total pounds landed	Drift	147,221,522	54,965,123	60,545,242	9,039,937	8,624,445	14,046,775
	Set	34,004,833	21,551,668	4,504,097	1,779,431	1,548,168	4,621,469
	Total	181,226,355	76,516,791	65,049,339	10,819,368	10,172,613	18,668,244
	% of total	100.0%	42.2%	35.9%	6.0%	5.6%	10.3%
Estimated gross earnings	Drift	$134,136,756	$49,465,892	$55,341,651	$8,383,182	$8,058,292	$12,887,739
	Set	$31,022,079	$19,527,908	$4,178,869	$1,617,831	$1,448,873	$4,248,599
	Total	$165,158,835	$68,993,800	$59,520,520	$10,001,013	$9,507,165	$17,136,338
	% of total	100.0%	41.8%	36.0%	6.1%	5.8%	10.4%
Average gross earnings per permit fished	Drift	$89,784	$76,101	$102,866	$96,358	$92,624	$93,389
	Set	$36,030	$34,502	$33,701	$40,446	$41,396	$42,486
	Total	$70,131	$56,738	$89,910	$78,748	$77,928	$72,001

Source: CFEC Permit and Fishing Activity Data.

Table A-4 shows how we estimated seasonal and annual average employment in Bristol Bay salmon *fishing* in 2010. We started with the ADLWD estimate of 7035 for seasonal employment, and allocated this among states based on the distribution of limited entry permits. In doing this, we in effect assumed that fishing crew live in the same states as permit holders, and that the average number of crew per fishing operation is the same across states. Although neither of these assumptions is completely accurate, we had no other data with which to develop a better way of allocating crew among states.

As also discussed in Appendix B, in November 2012 we conducted a short online survey of 21 Washington residents who held Bristol Bay permits (20 drift gillnet permits and 1 set gillnet permit) about their fishing operations, primarily to learn more about their expenditures associated with the fishery. Of these, 13 responded that all of their crew were from Washington, and another 5 responded that some of their crew were from Washington. This suggests that most though not all Bristol Bay crew are likely to be from the same states as the permit holders with whom they fish. Moreover, to the extent that they are not, California residents hired as crew by Washington residents may be partially "balanced" by Washington residents hired as crew by California residents—and so forth for other states considered in our study.

Table A-4

Estimated Employment in Bristol Bay Salmon Fishing, 2010

	Sources & notes	Total	AK	WA	OR	CA	Other states
Assumed total seasonal fishing employment	a	7035					
Assumed share of fishing employment, by state	b	100.0%	53.1%	27.7%	4.9%	5.1%	9.2%
Assumed seasonal fishing employment, by state	c	7035	3734	1948	345	362	646
Assumed annual average fishing employment, by state	d	1173	622	325	57	60	108

(a) Estimated salmon harvesting employment, July, from Table IV-2.

(b) Share of total permit holders, by state, from Table IV-3.

(c) Calculated by multiplying assumed total seasonal employment by the assumed share of fishing employment by state.

(d) Calculated by dividing assumed seasonal employment by 6, based on the assumption that Bristol Bay seasonal fishing jobs represent 2 months employment on average.

Table A-5

Responses of Washington residents who hold Bristol Bay permits to the question "What state did the people who worked for you live in?"

State(s)	Number of responses
Washington	13
Washington & California	2
Washington & Alaska	1
Washington & Utah	1
Washington, Alaska & New Mexico	1
Oregon & Alaska	1
Texas & Colorado	1
Maine	1
Total	**21**

Source: November 2012 survey of Washington permit holders. See discussion in Appendix B.

Table A-6 shows how we estimated seasonal and annual average employment in Bristol Bay salmon *processing* in 2010. We begin with the ADLWD figure for the Bristol Bay region 2010 seafood processing worker total count of 4866, which we assume as a measure of total 2010 seasonal employment in Bristol Bay salmon seafood processing. The same data source reports that 87% of these workers were non-Alaska residents, which implies that 4251workers were non-Alaska residents and 635 were Alaska residents.

ADLWD did not report what states the non-resident workers lived in. To estimate this, we used unpublished data provided to us by ADLWD for Alaska unemployment payments to non-resident manufacturing workers (most of whom work in fish processing) to calculate the percentage of these unemployment insurance payments received by residents of Washington, Oregon, California, and other states. We assumed—in the absence of an alternative better approach—that Bristol Bay nonresident processing employment was distributed in the same proportions.

Table A-6

Estimated Employment in Bristol Bay Salmon Processing, 2010

	Notes	Total	AK	WA	OR	CA	Other states	Total Non-Alaska
Bristol Bay region seafood processing total worker count	a	4886						
Percent of Bristol Bay region seafood processing workers, by residency	a	100.0%	13.0%					87.0%
Assumed Alaska and non-Alaska worker count	b		635					4251
Alaska unemployment payments to manufacturing workers, 2010, by state to which payments were sent	c			$8,198,281	$1,334,785	$11,411,708	$6,298,954	$27,243,728
Share of non-Alaska unemployment payments	d			30.1%	4.9%	41.9%	23.1%	100.0%
Assumed non-Alaska worker count by state	e			1279	208	1781	983	4251
Assumed seasonal employment in Bristol Bay processing	f	4886	635	1279	208	1781	983	
Assumed annual average employment in Bristol Bay processing	g	**814**	**106**	**213**	**35**	**297**	**164**	

(a) Source: ADLWD Bristol Bay Region Seafood Processing Employment and Earnings Data; (b) Calculated from (a); (c) Source: Unpublished data provided by Alaska Department of Labor and Workforce Development, Research and Analysis Section, for payments to workers in NAICS code 31 (Manufacturing) which is dominated in Alaska by fish processing; (d) Calculated from (c); ((d) Calculated from percentages of workers by residency; (e) Assumed based on (d): assumes that Bristol Bay non-Alaska processing employment and processing wages were distributed geographically in the same proportion as statewide non-Alaska manufacturing unemployment insurance payments; (f) Values calculated in rows above; (g) Calculated by dividing estimated seasonal employment by 6, based on the assumption that Bristol Bay seasonal processing jobs represent 2 months employment, on average.

Note that this method of allocating non-resident processing employment assumed that all Bristol Bay processing workers lived in the United States. This was clearly not the case, given the fact that some of the workers were foreigners working in Alaska under the J-1 summer work travel visa program. In 2010, a total of 4383 workers in Alaska held J-1 summer work travel visas (http://j1visa.state.gov/basics/facts-and-figures/). Many but not all of these worked in the seafood processing industry: some worked in other industries such as tourism. This compares with a total worker count of 23,432 for the Alaska statewide seafood processing industry (http://laborstats.alaska.gov/seafood/statewide/AKSFPOver.pdf). If all J-1 visa holders had worked in the seafood industry, they would have represented 19% of the statewide processing workforce. Their share in the Bristol Bay processing workforce could have been the same, higher or lower. Had it been the same, actual employment of residents of states other than Alaska would have been about 81% of our estimates in Table A-6.

The J-1 summer work travel visa program is being phased out. Within a few years, it is likely that almost all Bristol Bay workers will be US residents.

Map in a Bristol Bay processor's cafeteria with pins showing where the workers were from

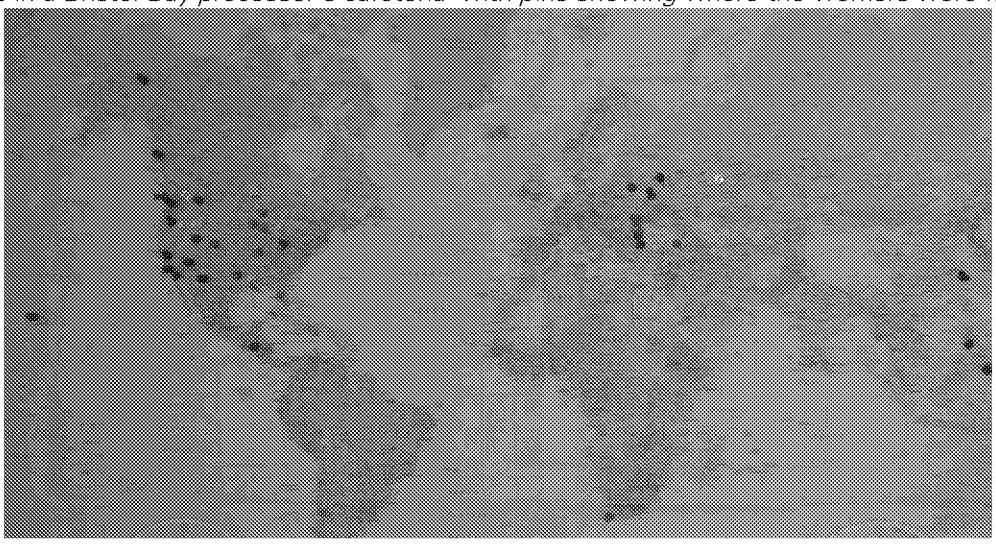


Table A-7 summarizes our estimates of seasonal employment in Bristol Bay salmon and fishing derived in Tables A-5 and A-7. The totals, which correspond to the first line of Table A-1 at the beginning of this chapter, are the estimated direct seasonal employment impacts of Bristol Bay salmon fishing and processing in 2010.

Table A-7

Estimated Seasonal Employment in Bristol Bay Salmon Fishing & Processing, 2010

	Total	AK	WA	OR	CA	Other states
Fishing	7,035	3,734	1,948	345	362	646
Processing	4,886	635	1,279	208	1,781	983
Total	**11,921**	**4,369**	**3,227**	**553**	**2,143**	**1,629**

Sources: Estimates in Tables IV-5 (fishing) and IV-6 (processing).

Note: Estimates are by workers' state of residence.

Table A-8 shows our estimates of annual average employment in Bristol Bay fishing and processing. These estimates are simply the seasonal estimates shown in Table A-7 divided by 6—based on the assumption that each seasonal fishing and processing job in Bristol Bay represents, on average, the equivalent of two months of work. The totals, which correspond to the second line of Table A-1 at the beginning of this chapter, are the estimated direct annual average employment impacts of Bristol Bay salmon fishing and processing in 2010.

Table A-8

Estimated Annual Average Employment in Bristol Bay Salmon Fishing & Processing, 2010

	Total	AK	WA	OR	CA	Other states
Fishing	1,173	622	325	57	60	108
Processing	814	106	213	35	297	164
Total	**1,987**	**728**	**538**	**92**	**357**	**271**

Sources: Estimates in Tables IV-5 (fishing) and IV-6 (processing). Calculated by dividing assumed seasonal employment by 6, based on the assumption that Bristol Bay seasonal fishing jobs represent 2 months employment on average.

Note: Estimates are by workers' state of residence.

Estimation of Direct Income Impacts

The direct income impacts of Bristol Bay salmon and fishing are the income people earn from fishing and processing in Bristol Bay. As shown in Table A-9, we estimated three components of these direct income impacts: the income earned by fishing crew, the income of permit holders (after subtracting their operating expenses from their gross income), and the income of processing workers.

Table A-9

Estimated Direct Income Impacts of Bristol Bay Salmon Fishing and Processing, 2010

	Total	AK	WA	OR	CA	Other states
Payments to fishing crew (a)	$37,074,363	$15,451,313	$13,399,581	$2,246,435	$2,135,997	$3,841,037
Permit holder income net of operating expenses (a)	$72,668,608	$30,760,455	$25,758,280	$4,384,347	$4,162,374	$7,603,152
Processor payments to processing workers (b)	$33,963,492	$3,905,802	$9,045,069	$1,472,653	$12,590,406	$6,949,563
Total	**$143,706,463**	**$50,117,570**	**$48,202,930**	**$8,103,434**	**$18,888,777**	**$18,393,752**

Note: Estimates are by state of residence of income recipients.
(a) Source: Appendix B, Table B-5.
(b) Source: Table A-8.

We discuss our estimates of the income of fishing crew and permit holders in Appendix B. Table A-10 shows how we estimated wage earnings of processing workers, starting with total Bristol Bay processing wage earnings reported by the Alaska Department of Labor and Workforce Development, and allocating these by states based on the geographic distribution of unemployment insurance payments, in the same way as we estimated the geographic distribution of processing employment in Table A-6.

Table A-10

Estimated Wage Earnings in Bristol Bay Salmon Processing, 2010

	Notes	Total	AK	WA	OR	CA	Other states	Total Non-Alaska
Alaska unemployment payments to manufacturing workers, 2010, by state to which payments were sent	a	$41,585,887	$14,342,159	$8,198,281	$1,334,785	$11,411,708	$6,298,954	$27,243,728
Share of non-Alaska unemployment payments	b			30.1%	4.9%	41.9%	23.1%	100.0%
Total Bristol Bay processing industry wage payments	c	$33,963,492						
Percent of Bristol Bay processing wage payments, by residency	c	100.0%	11.5%					88.5%
Bristol Bay processing industry wage payments, by residency	h		$3,905,802					$30,057,690
Assumed non-Alaska wage payments, by state	e			$9,045,069	$1,472,653	$12,590,406	$6,949,563	
Assumed Bristol Bay payments to processing workers, by state	f	**$33,963,492**	**$3,905,802**	**$9,045,069**	**$1,472,653**	**$12,590,406**	**$6,949,563**	

Sources and notes: (a) Source: Unpublished data provided by Alaska Department of Labor and Workforce Development, Research and Analysis Section, for payments to workers in NAICS code 31 (Manufacturing) which is dominated in Alaska by fish processing; (b) Calculated from (a); (c) Source: ADLWD Bristol Bay Region Seafood Processing Employment and Earnings Data; (d) Calculated from percentages of workers by residency; (e) Assumed based on (b): assumes that Bristol Bay non-Alaska processing employment and processing wages were distributed geographically in the same proportion as statewide non-Alaska unemployment insurance payments; (f) Values calculated in rows above; (g) Calculated by dividing estimated seasonal employment by 6, based on the assumption that Bristol Bay seasonal processing jobs represent 2 months employment, on average; (h) Calculated from percentages of wage payments by residency.

Appendix C

Estimation of Direct Output Value Impacts

The output value of Bristol Bay salmon fishing and processing includes the output value created in fishing (the ex-vessel value paid to fishermen) and the additional value increases in primary processing (the total first wholesale value of Bristol Bay production minus the ex-vessel value).

Ex-Vessel Value of Bristol Bay Salmon Harvests

The ex-vessel value of Bristol Bay salmon harvests is the total amount paid to Bristol Bay permit holders by processors; it is equivalent to *permit holders gross earnings*. Two sources of data are available for ex-vessel value:

- *CFEC data:* Data published by the Alaska Commercial Fisheries Entry Commission (CFEC) in several places on the CFEC website at www.cfec.state.ak.us. The data distinguish between the ex-vessel value of harvests in the drift gillnet and set gillnet fisheries, but do not distinguish between ex-vessel value by species.

- *ADF&G data*: Data published by the Alaska Department of Fish and Game (ADF&G) on the ADF&G website in annual "Alaska Commercial Salmon Harvests and Ex-Vessel Values" tables at http://www.adfg.alaska.gov/index.cfm?adfg=commercialbyfisherysalmon.salmoncatch. The data distinguish between the value of harvests by species, but do not distinguish between the value of harvests in the drift gillnet and set gillnet fisheries.

As shown in Table A-11, these two data sources provide different estimates of the total value of the Bristol Bay salmon harvest. In most years the estimates are fairly close, but in 2010—the year for which we prepared our economic impacts—they differed significantly, by $20 million. It is not clear why they differ, or which estimate is more accurate. In this report, for our analysis of economic impacts, we used the lower CFEC estimate of $165 million (shown in the shaded cell of the table) as our assumption for the 2010 ex-vessel value, because we were also relying on CFEC data for our assumptions about the distribution of permit holders and permit holder earnings by state. In Chapter II, for our discussion of trends over time in Bristol Bay sockeye salmon prices and value (Figure II-4) and our discussion of the relative share of Bristol Bay sockeye salmon in Alaska and world salmon harvest value (Table II-3) we used ADF&G data because they are specific to sockeye salmon.

Table A-11
CFEC & ADF&G Estimates of the Ex-Vessel Value of the Bristol Bay Salmon Harvest

Data source	Species or fishery	2008	2009	2010	2011
CFEC data	Drift gillnet fishery	$100,139,700	$122,005,800	$134,136,756	$131,544,714
	Set gillnet fishery	$20,955,694	$26,211,898	$31,022,079	$27,365,503
	Total	**$121,095,394**	**$148,217,698**	**$165,158,835**	**$158,910,217**
ADFG Data	Sockeye salmon	$116,717,000	$144,200,000	$180,818,000	$158,383,000
	Other species	$2,221,000	$2,075,000	$4,210,000	$2,107,000
	Total	**$118,938,000**	**$146,275,000**	**$185,028,000**	**$160,490,000**

Sources: CFEC Basic Information Tables and CFEC Permit and Fishing Activity Data; ADF&G Alaska Commercial Salmon Harvests and Ex-vessel Values Reports.

Increase in Value in Primary Processing

The increase in value in primary processing of Bristol Bay salmon is the total first wholesale value minus the ex-vessel value. Reliable data on first wholesale value are available from the Commercial Operator Annual Reports filed every year by processors, in which they report their total production and total first wholesale value (FOB Bristol Bay) by product and species. The total first wholesale value of Bristol Bay production in 2010 was $389,667,996 (the shaded cell in Table A-12). This is one of the most important numbers reported in this study. It clearly shows that the total direct output value impact of Bristol Bay salmon fishing and processing in 2010 was very large—measured in the hundreds of millions of dollars.

As will be apparent from Appendixes B and D, estimating the multiplier impacts of Bristol Bay fishing and processing required us to make numerous "best judgment" assumptions, based on discussions with industry sources and our own knowledge of the industry, about how payments from first wholesale value are allocated across industries and states. The uncertainty associated with these assumptions imparts uncertainty to our estimates of multiplier impacts. However, regardless of how payments from first wholesale value are allocated by industry or among states, the scale of direct output value impacts means that the national multiplier impacts of Bristol Bay salmon and processing were also very large.

Table A-12

Volume, First Wholesale Value and Average First Wholesale Price of Bristol Bay Salmon Primary Production, 2010

	Total	Frozen	Canned	Fresh	Roe
Volume (pounds)	116,718,352	79,961,576	29,895,751	2,899,396	3,961,628
Value ($)	**$389,667,996**	$258,255,152	$105,376,086	$6,119,811	$19,916,948
Average price ($/lb)		$3.23	$3.52	$2.11	$5.03

Source: Alaska Department of Fish and Game, Commercial Operator Annual Reports database.
Note: Excludes small volumes and values of other products for which data were confidential.

Table A-13 summarizes our direct output value assumptions. The direct output value in processing is the difference between the total first wholesale value of $389,667,996 (from Table A-11) and total ex-vessel value of $165,158,835 (from Table A-10), or $224,509,160. Output value is allocated by the states to which payments from output value are made. For example, if a processor buys $1,000,000 of cans from a company in California, that portion of output value is allocated to California. If a permit holders pays $50,000 to a crew member from Washington, that portion of output value is allocated to Washington. We discuss our assumptions about the allocation of payments among states in detail in Appendix B.

Table A-13

Estimated Direct Output Value Impacts of Bristol Bay Salmon Fishing and Processing, 2010

	Total	AK	WA	OR	CA	Other states
Fishing	$165,158,836	$83,306,625	$55,577,935	$7,163,324	$6,807,849	$12,303,103
Processing	$224,509,160	$43,355,550	$142,913,670	$6,257,029	$12,590,406	$19,392,506
Total	$389,667,996	$126,662,175	$198,491,605	$13,420,353	$19,398,255	$31,695,609

Note: Impacts are allocated to the states to which payments are made.

Sources: See Table A-11 for discussion of total output value created in fishing (= total ex-vessel value). See Table A-12 for discussion of total direct output value (= total first wholesale value). Total direct output value in processing (= total value increase in processing) was calculated by substracting total ex-vessel value from total first wholesale value. See Appendix B, and particularly Tables B6 and B8, for discussion of the allocation of total ouput value (total payments) among states.

APPENDIX B:
ESTIMATION OF MULTIPLIER ECONOMIC IMPACTS OF BRISTOL BAY SALMON FISHING AND PROCESSING

The multiplier economic impacts of Bristol Bay salmon fishing and processing are the indirect and induced impacts on other industries driven by payments of fishermen and processors to businesses and households. In this appendix, we discuss our estimation of these impacts. We organize our discussion as follows:

- Estimation of permit holder payments by industry and state
- Estimation of processor payments by industry and state
- Estimation of multiplier impacts using IMPLAN models

Estimation of Permit Holder Payments by Industry and State

We estimated permit holder payments separately for each fishery based on surveys conducted by the Commercial Fisheries Entry Commission (CFEC) for the 2001 set gillnet fishery and by Northern Economics for the 2001 set gillnet fishery.

The CFEC survey was conducted in 2002 and received responses from 310 Bristol Bay drift gillnet permit holders (Schelle, 2002; Carlson, 2002). Subsequently, CFEC used the survey responses and other CFEC data to estimate nominal average gross earnings, costs and net returns of drift gillnet permit holders for the years 1983-2003 (Schelle et al, 2004). Table B-1 shows how we used these CFEC estimates of nominal costs for the years 1983-2003 to estimate total payments of the drift gillnet fishery by category in 2010.

Note that we could not simply adjust average 1983-2003 payments for inflation, because both catches and prices varied widely over this period and from 2010. For most payment categories, we assumed, based on our best judgment, either that average real expenditures remained constant, real expenditures per pound remained constant, the share of payments in total expenditures remained constant, or a weighted combination of these assumptions.[2]

[2] As shown in footnote f of Table B-1, crew share was calculated as 22.55% of total earnings. This percentage was based on the average for the years 1983-2003 of the CFEC estimated crew payment as a percentage of total earnings minus estimated payments for food and fuel. To be exactly consistent with the CFEC estimates, our estimated crew payments for 2010 should have been 22.55% of total earnings minus estimated 2010 payments for food and fuel. This would have resulted in slightly lower estimates of $19,031 for average crew payments and $28,432,674 for total crew payments--and correspondingly higher estimates of average returns to labor, management and investment. However, this would not have made any difference in our economic impact calculations, because payments to crew and payments to permit holders (as average returns to labor, management and investment) are assumed to have the same economic impacts and to be allocated among states in the same way.

Table B-1

Derivation of Payment Assumptions for the Drift Gillnet Fishery

Payment category	CFEC estimates of average real costs per drift gillnet permit holder, 1983-2003, expressed in 2010 dollars (a)	2010 payment assumptions (b)				Assumed payments per drift gillnet permit holder in 2010 (g)	Assumed total payments by drift gillnet permit holders in 2010 (h)
		Inflation-adjusted average CFEC cost (c)	Inflation-adjusted average CFEC cost per pound (d)	Share of CFEC costs (e)	Other (f)		
Food	$2,299	1				$2,299	$3,433,982
Fuel, oil and lubricants	$2,395	0.5	0.5			$3,089	$4,615,528
Crew payments	$21,824				1	$20,247	$30,249,506
Maintenance	$3,570	0.5	0.5			$4,305	$6,431,725
Nets	$3,010	0.5	0.5			$3,782	$5,651,033
Misc. gear & supplies	$1,884	0.5	0.5			$2,314	$3,457,811
Raw fish tax	$2,174			1		$2,213	$3,305,851
Transportation	$2,957	1				$2,957	$4,417,459
Moorage, gear, storage and haulout	$1,900	1				$1,900	$2,838,262
Insurance	$3,347	1				$3,347	$5,000,299
Administrative services	$973	1				$973	$1,454,133
Permit renewal fees	$586				1	$300	$448,200
Vessel license fees	$45	1				$45	$67,377
Property Tax	$466	1				$466	$696,336
Depreciation (= Replacement payments for vessels & gear) (i)	$3,078	1				$3,078	$4,598,642
Avg. Returns to Labor, Management, and Investment (= Retained by permit holders) (j)	$51,255					$38,468	$57,470,613
Average and total earnings	$101,763					$89,784	$134,136,756

(a) Calculated from K. Schelle, K.Iverson, N. Free-Sloan and S. Carlson, *Bristol Bay Salmon Drift Gillnet Fishery Optimum Number Report* (2004), Table 3.2a: *Bristol Bay Salmon Drift Gillnet Fishery, 1983-2003: Estimated (nominal $) Average Gross Earnings, Costs and Net Returns*. Annual payments converted to real (2010) dollars prior to averaging based on the United States Consumer Price Index.

(b) Relative weight given to four different methods of calculating assumed payments per permit holder in 2010, as described in notes (b)-(f).

(c) Assumes that 2010 average payments per permit holder were the same as average of CFEC estimated payments for 1983-2003, expressed in real (2010) dollars.

(d) Assumes that 2010 average payments per *pound* were the same as average of CFEC estimated payments *per pound* for 1983-2003, expressed in real (2010) dollars.

(e) Assumes that 2010 payments were the same share of gross earnings as average of CFEC estimated payments for 1983-2003, expressed in real (2010) dollars

(f) Assumes total crew share of 22.55% of gross earnings; average permit renewal fee is actual 2010 permit renewal fee.

(g) Weighted average of four alternative methods of calculating assumed average payments per permit holder in 2010.

(h) Calculated by multiplying average payments per permit holder in 2010 by the total number of permits fished in 2010 (1494).

(i) Depreciation was assumed to equal replacement payments for vessels and gear.

(j) Calculated as the residual after deducting all other payments from average and total earnings. Average returns to labor, management and investment were assumed to equal payments retained by permit holders.

The CFEC cost estimates included depreciation. For our analysis, we assumed that depreciation was equal to replacement expenditures for vessels and gear. Note that this assumption smooths out wide variation from year to year in actual replacement expenditures.[3]

[3] This variation is apparent from wide variation in the number of Bristol Bay drift gillnet boats in use in the fishery that were built in different years, which we estimated from the permit and vessel files posted on the CFEC website (http://www.cfec.state.ak.us/) by matching 2011 permit holders' vessel ADF&G numbers with the vessel file to get the year of construction of vessels. Of those 2011 permit holders whose permit file reported vessel ADF&G numbers, 223 had vessels built in 1980; 102 had vessels built in 1989, and 62 had vessels built in 1996. In dramatic contrast, only 2 had vessels built in 2001, only 1 had a vessel built in 2002, and none had a vessel built in 2003. Clearly, during the period 2001-2003, when economic conditions in the fishery were very poor, very little vessel

Note also that our assumption that replacement expenditures for vessels and gear equals depreciation does not account for new investment for upgrading (as opposed to simply replacing) vessels and gear, such as investment in larger boats or refrigeration capacity. Thus our analysis understates the economic impacts of the Bristol Bay fishery on the boat building and boat gear industries, which are based primarily in Washington State.

As a check on the reliability of our payment assumptions shown in Table B-1, in November 2012 we conducted a short online survey of 21 Washington residents who held Bristol Bay permits. Of these, 19 responded to questions about their costs in 2011. Note that our survey sample was not random and had higher average gross earnings ($101,292) than the average reported by CFEC ($85,315) for all drift permit holders in 2011 (CFEC Basic Information Tables). Thus, to the extent that higher-than-average-earning fishermen also have higher-than-average costs, we would expect responses of our survey respondents to be slightly higher than our average payment assumptions for the fishery as a whole. In general, this appears to have been the case. While our survey size was too small and non-representative to provide a reliable measure of average payments for the fishery as a whole, nothing in our survey results suggests that our average payment assumptions for the 2010 fishery, as derived in Table B-1, are unreasonable.

Table B-2

Comparison of Drift Gillnet Permit Holder Average Payment Assumptions with Survey Responses

Payment category	Assumed payments per drift gillnet permit holder in 2010 (a)	Survey Responses (b)		
		Minimum	Average	Maximum
Food	$2,299	$1,000	$2,213	$4,500
Fuel, oil and lubricants	$3,089	$1,580	$4,312	$8,000
Crew payments	$20,247	$12,000	$30,512	$77,500
Maintenance	$4,305	$1,200	$16,526	$85,000
Transportation	$2,957	$1,580	$4,312	$8,000
Insurance	$3,347	$1,000	$2,372	$5,000
Other expenses (c)	**$11,994**	**$0**	**$9,490**	**$27,500**
Nets	$3,782			
Misc. gear & supplies	$2,314			
Raw fish tax	$2,213			
Moorage, gear, storage and haulout	$1,900			
Administrative services	$973			
Permit renewal fees	$300			
Vessel license fees	$45			
Property Tax	$466			
Depreciation	$3,078			
Avg. Returns to Labor, Management, and Investment	$38,468			
Average and total earnings	$89,784	$75,000	$101,292	$180,000

(a) Table B-1.

(b) Responses of 19 Washington State drift gillnet permit holders to an informal survey about operating expenses during the 2011 salmon season.

(c) Excludes depreciation and average returns to labor, management and investment.

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replacement took place. As economic conditions in the fishery improved in recent years, so did the number of boats being built. Of 2011 permit holders, 6 had boats built in 2009, 15 had boats built in 2010, and 18 had boats built in 2011.

We based our estimates of 2010 payments from the set gillnet fishery on estimates of average payments per set net permit holder in 2001, based on the data shown in Table B-3. These data were reported in an analysis done by Northern Economics (NE) for a 2003 analysis of options for restructuring the Bristol Bay salmon fishery (Northern Economics, *Assessment of Wealth in the Status Quo Fishery,* 2003). NE estimated payments for permit holders from three geographic areas (local, other Alaska, and non-Alaska) and three revenue rankings (low, medium, and high), using data supplied by the Commercial Fisheries Entry Commission (CFEC) for the number of permits, catches and gross earnings for each permit group. Note that these should be considered very approximate estimates. As described by Northern Economics:

> "Costs were estimated by Northern Economics through a series of telephone interviews with set net operators. A total of 15 operators were interviewed in October 2001, and the results from those interviews along with a set of assumptions on the part of the analysts were used to estimate typical costs in the set net fishery. Because of the very limited sample from the set net fishery, the information in the estimates of net revenues and wealth carries additional uncertainty. It should also be noted that the limited sample precluded stratification by residence and average catch. None-the-less, adjustments for residence and catch size were developed by the analysts based on their experience and judgment."

Table B-3

Northern Economics' Estimates of Average Earnings and Payments per Permit Holder in the Bristol Bay Set Gilnet Fishery, by Class, 2001, and Estimation of Average Payments per Permit Holder

	Local permit holders			Other Alaska permit holders			Non-Alaska permit holders			Estimated total, all classes combined	Estimated average payments per permit holder
Item	LR-Low	LR-Med	LR-High	OA-Low	Med.	OA-High	NA-Low	Med.	NA-High	(a)	(b)
Number of permits	78	124	143	56	94	112	53	95	87	842	
Total catch per permit (lbs)	$8,604	$21,929	$40,662	$8,553	$19,948	$37,788	$6,274	$18,191	$33,904	20,801,625	
Gross earnings per permit	$3,498	$8,798	$16,450	$3,501	$8,229	$15,476	$2,597	$7,553	$13,984	$8,490,824	$10,084
Payments per permit											
Crew payments	$166	$418	$782	$167	$391	$736	$123	$359	$665	$403,623	$479
Transportation	$0	$0	$0	$500	$500	$500	$1,000	$1,000	$1,000	$366,000	$435
Food	$575	$619	$683	$575	$614	$675	$567	$609	$663	$530,378	$630
Fuel, oil and lubricants	$126	$318	$595	$127	$297	$559	$94	$273	$506	$306,922	$365
Maintenance	$675	$817	$1,022	$675	$801	$996	$650	$783	$956	$716,757	$851
Nets	$461	$558	$699	$461	$548	$681	$445	$536	$654	$490,110	$582
Misc. gear & supplies	$879	$1,065	$1,332	$879	$1,045	$1,298	$848	$1,021	$1,246	$934,269	$1,110
Insurance	$161	$173	$191	$161	$172	$189	$159	$170	$185	$148,347	$176
Moorage, gear, storage and haulout	$105	$157	$232	$105	$152	$223	$96	$145	$208	$142,937	$170
Raw fish tax	$175	$440	$822	$175	$411	$774	$130	$378	$699	$424,491	$504
Vessel license fees	$100	$100	$100	$100	$100	$100	$100	$100	$100	$84,200	$100
Permit renewal fees	$312	$312	$312	$312	$312	$312	$312	$312	$312	$262,704	$312
Administrative services	$65	$165	$308	$66	$154	$290	$49	$141	$262	$159,012	$189
Fixed costs	$2,765	$3,278	$4,019	$3,265	$3,723	$4,425	$3,678	$4,158	$4,780	$3,231,065	$3,837
Variable costs	$1,036	$1,864	$3,060	$1,036	$1,775	$2,908	$895	$1,669	$2,674	$1,738,714	$2,065
Total costs	$3,801	$5,142	$7,079	$4,301	$5,498	$7,332	$4,573	$5,827	$7,455	$4,969,754	$5,902
Net returns	-$302	$3,656	$9,371	-$800	$2,731	$8,144	-$1,975	$1,726	$6,530	$3,521,288	$4,182

Source: Northern Economics, *Assessment of Wealth in the Status Quo Fishery* (2003), Table 21.
(a) Total payments estimated by multiplying average payments per permit by the number of permits for each class, and summing across classes.
(b) Average payments per permit holder estimated by dividing total payments by the total number of set net permit holders.

Table B-4 shows how we estimated 2010 payments based on the NE estimates of average payments per permit holder in 2001. We could not simply adjust all 2001 payments for inflation, because both catches and prices were significantly higher in 2010 than in 2001. For most payment categories, we assumed either that real expenditures remained constant, real expenditures per pound remained constant, the share of payments in total expenditures remained constant, or a weighted combination of these assumptions.

Table B-4

Derivation of Payment Assumptions for the Set-Net Fishery

Payment category	Estimated average payments per permit holder in 2001 (a)	Estimated average payments per permit holder in 2001, expressed in 2010 dollars (b)	Weighting of methodologies used to develop 2010 payment assumptions (c)				Assumed payments per permit holder in 2010 (h)	Assumed total payments by set-net permit holders in 2010 (i)
			Inflation-adjusted average 2001 payment (d)	Inflation-adjusted average 2001 payment per pound (e)	Share of 2001 payments (f)	Other (g)		
Food	$630	$776	1				$776	$667,769
Fuel, oil and lubricants	$365	$449	0.5	0.5			$580	$499,151
Crew payments	$479	$590				1	$7,927	$6,824,857
Maintenance	$851	$1,048	0.5	0.5			$1,354	$1,165,671
Nets	$582	$717	0.5	0.5			$926	$797,072
Misc. gear & supplies	$1,110	$1,366	0.5	0.5			$1,765	$1,519,413
Raw fish tax	$504	$621			1		$1,784	$1,536,135
Transportation	$435	$535	1				$535	$460,810
Moorage, gear, storage and haulout	$170	$209	1				$209	$179,964
Insurance	$176	$217	1				$217	$186,775
Administrative services	$189	$233	1				$233	$200,203
Permit renewal fees	$312	$384	1				$150	$129,150
Vessel license fees	$100	$123	1				$123	$106,011
Property Tax			1				$0	$0
Depreciation (= Replacement payments for vessels & gear) (j)						1	$1,802	$1,551,104
Avg. Returns to Labor, Management, and Investment (= Retained by permit holders) (k)	$4,279	$5,268					$17,652	$15,197,995

(a) Source: Table B-3. Estimated from data in Northern Economics, *Assessment of Wealth in the Status Quo Fishery* (2003), Table 21.

(b) Estimated by multiplying 2001 estimates by the ratio of the US CPI in 2010 to the ratio of the US CPI in 2001 (218.056/177.1 = 1.231).

(c) Relative weight given to four different methods of calculating assumed payments per permit holder in 2010, as described in notes (d)-(g).

(d) Assumes that average payments per permit holder were the same as in 2001, after adjusting for inflation.

(e) Assumes that average payments *per pound* were the same as in 2001, after adjusting for inflation.

(f) Assumes that payments were the same share of gross earnings as in 2001.

(g) Assumes crew shares of 10% of earnings per crew for an average of 2.2 crew per permit holder (= 22% of average earnings of $36,030 per permit holder or 22% of total earnings of $31,022,079); assumes depreciation of 5% of average and gross earnings.

(h) Weighted average of four alternative methods of calculating assumed average payments per permit holder in 2010.

(i) Calculated by multiplying average payments per permit holder in 2010 by the total number of permits fished in 2010 (861).

(j) Depreciation was assumed to equal replacement payments for vessels and gear.

(k) Calculated as the residual after deducting all other payments from average and total earnings. Average returns to labor, management and investment were assumed to equal payments retained by permit holders.

Table B-5 shows our combined payment assumptions for both the drift gillnet and set gillnet fishery, by the *state of residency of the permit holders*. The "Total" column of Table B-5 combines our total payment assumptions for the drift gillnet fishery (from Table B-1) and the set gillnet fishery (from Table B-4). The gross earnings rows of the table are CFEC data reported in Table A-3. We assumed that the share of residents of each state in each type of payment is proportional to their share of earnings. For

example, since Washington residents accounted for 41.3% of gross earnings in the drift gillnet fishery, we assume that they also accounted for 41.3% of food payments, fuel payments, and so forth.[4]

Table B-5

Assumed Total Expenditures of Permit Holders, by Residency of Permit Holders

		Total	Alaska	Washington	Oregon	California	Other States
Drift gillnet fishery	**Gross Earnings**	**$134,136,756**	**$49,465,892**	**$55,341,651**	**$8,383,182**	**$8,058,292**	**$12,887,739**
	Food	$3,433,982	$1,266,357	$1,416,780	$214,615	$206,297	$329,934
	Fuel, oil, & lubricants	$4,615,528	$1,702,078	$1,904,258	$288,458	$277,279	$443,456
	Crew shares (excluding skipper)	$30,249,506	$11,155,174	$12,480,230	$1,890,512	$1,817,245	$2,906,345
	Maintenance (routine & unexpected)	$6,431,725	$2,371,841	$2,653,577	$401,965	$386,387	$617,954
	Nets (hanging, repair, and web)	$5,651,033	$2,083,943	$2,331,483	$353,174	$339,487	$542,946
	Miscellaneous gear & supplies	$3,457,811	$1,275,144	$1,426,611	$216,104	$207,729	$332,223
	Raw fish tax	$3,305,851	$1,219,105	$1,363,916	$206,607	$198,600	$317,623
	Transportation	$4,417,459	$1,629,036	$1,822,539	$276,079	$265,380	$424,426
	Moorage, storage, and haul-out	$2,838,262	$1,046,672	$1,171,000	$177,384	$170,509	$272,698
	Insurance (P&I, hull, lay-up)	$5,000,299	$1,843,971	$2,063,005	$312,505	$300,394	$480,424
	Administrative services	$1,454,133	$536,244	$599,941	$90,879	$87,357	$139,712
	Annual permit fee	$448,200	$165,284	$184,917	$28,011	$26,926	$43,063
	Annual vessel license fee	$67,377	$24,847	$27,798	$4,211	$4,048	$6,473
	Property Tax	$696,336	$256,789	$287,292	$43,519	$41,833	$66,903
	Vessel and gear replacement	$4,598,642	$1,695,851	$1,897,291	$287,403	$276,264	$441,833
	Retained by permit holders	$57,470,613	$21,193,558	$23,711,015	$3,591,757	$3,452,558	$5,521,725
Set gillnet fishery	**Gross Earnings**	**$31,022,079**	**$19,527,908**	**$4,178,869**	**$1,617,831**	**$1,448,873**	**$4,248,599**
	Food	$667,769	$420,350	$89,953	$34,825	$31,188	$91,454
	Fuel, oil, & lubricants	$499,151	$314,208	$67,239	$26,031	$23,313	$68,361
	Crew shares (excluding skipper)	$6,824,857	$4,296,140	$919,351	$355,923	$318,752	$934,692
	Maintenance (routine & unexpected)	$1,165,671	$733,771	$157,023	$60,791	$54,442	$159,643
	Nets (hanging, repair, and web)	$797,072	$501,744	$107,371	$41,568	$37,227	$109,162
	Miscellaneous gear & supplies	$1,519,413	$956,446	$204,674	$79,239	$70,964	$208,090
	Raw fish tax	$1,536,135	$966,972	$206,927	$80,111	$71,745	$210,380
	Transportation	$460,810	$290,072	$62,074	$24,032	$21,522	$63,110
	Moorage, storage, and haul-out	$179,964	$113,284	$24,242	$9,385	$8,405	$24,647
	Insurance (P&I, hull, lay-up)	$186,775	$117,572	$25,160	$9,741	$8,723	$25,580
	Administrative services	$200,203	$126,025	$26,969	$10,441	$9,350	$27,419
	Annual permit fee	$129,150	$81,298	$17,397	$6,735	$6,032	$17,688
	Annual vessel license fee	$106,011	$66,733	$14,280	$5,529	$4,951	$14,519
	Property Tax	$0	$0	$0	$0	$0	$0
	Vessel and gear replacement	$1,551,104	$976,395	$208,943	$80,892	$72,444	$212,430
	Retained by permit holders	$15,197,995	$9,566,897	$2,047,265	$792,590	$709,816	$2,081,427
Total: drift gillnet and set gillnet fisheries	**Gross Earnings**	**$165,158,835**	**$68,993,800**	**$59,520,520**	**$10,001,013**	**$9,507,165**	**$17,136,338**
	Food	$4,101,750	$1,686,706	$1,506,732	$249,439	$237,485	$421,387
	Fuel, oil, & lubricants	$5,114,679	$2,016,286	$1,971,496	$314,489	$300,591	$511,817
	Crew shares (excluding skipper)	$37,074,363	$15,451,313	$13,399,581	$2,246,435	$2,135,997	$3,841,037
	Maintenance (routine & unexpected)	$7,597,395	$3,105,612	$2,810,601	$462,756	$440,829	$777,598
	Nets (hanging, repair, and web)	$6,448,105	$2,585,687	$2,438,853	$394,742	$376,714	$652,108
	Miscellaneous gear & supplies	$4,977,224	$2,231,591	$1,631,286	$295,343	$278,692	$540,313
	Raw fish tax	$4,841,985	$2,186,078	$1,570,843	$286,718	$270,344	$528,003
	Transportation	$4,878,269	$1,919,108	$1,884,613	$300,111	$286,902	$487,535
	Moorage, storage, and haul-out	$3,018,226	$1,159,956	$1,195,242	$186,769	$178,914	$297,344
	Insurance (P&I, hull, lay-up)	$5,187,074	$1,961,543	$2,088,165	$322,246	$309,117	$506,004
	Administrative services	$1,654,336	$662,268	$626,909	$101,320	$96,708	$167,130
	Annual permit fee	$577,350	$246,582	$202,314	$34,747	$32,958	$60,750
	Annual vessel license fee	$173,388	$91,579	$42,078	$9,739	$8,999	$20,992
	Property Tax	$696,336	$256,789	$287,292	$43,519	$41,833	$66,903
	Vessel and gear replacement	$6,149,746	$2,672,246	$2,106,234	$368,294	$348,708	$654,263
	Retained by permit holders	$72,668,608	$30,760,455	$25,758,280	$4,384,347	$4,162,374	$7,603,152

Note: Gross earnings are CFEC data reported in Table A-3. Total payments for each fishery are estimates from Tables B-1 and B-4. All payments are allocated among permit holders from different states in proportion to their share of gross earnings.

[4] Probably non-Alaska residents should account for a larger share of transportation payments, but we had no clear way of estimating how much larger. Recall also that many Alaska residents who live in other parts of Alaska also face high transportation costs to get to Bristol Bay.

For the purposes of estimating economic impacts, what matters is not where the permit holders who made the payments lived, but what states they made payments to. Table B-6 shows our assumptions about how permit holders allocated payments among states, by permit holder residency and type of payment. A key assumption was that where permit holders made payments to depends upon where they lived. For example, as shown in the first row of the table, we assumed that Alaska residents spent 100% of their payments for food in Alaska, while residents of other states spent 57% of their payments for food in Washington (based on reported responses of Washington State residents to our November 2012 survey of drift gillnet permit holders).

Table B-6

Assumed Distribution of Expenditures by State, by Residency of Permit Holders

	Alaska permit holders		Washington permit holders		Oregon permit holders			California permit holders			Other permit holders		
Type of payment	AK	WA	AK	WA	AK	WA	OR	AK	WA	CA	AK	WA	OS
Food*	1.00		0.43	0.57	0.43	0.57		0.43	0.57		0.43	0.57	
Fuel, oil, & lubricants	1.00		1.00		1.00			1.00			1.00		
Crew shares (excluding skipper)	1.00			1.00			1.00			1.00			1.00
Maintenance (routine & unexpected)*	1.00		0.71	0.29	0.71	0.29		0.71	0.29		0.71	0.29	
Nets (hanging, repair, and web)*	1.00		0.71	0.29	0.71	0.29		0.71	0.29		0.71	0.29	
Miscellaneous gear & supplies	1.00		0.25	0.75	0.25	0.75		0.25	0.75		0.25	0.75	
Raw fish tax	1.00		1.00		1.00			1.00			1.00		
Transportation	1.00		0.10	0.90	0.10		0.90	0.10		0.90	0.10		0.90
Moorage, storage, and haul-out	1.00		1.00		1.00			1.00			1.00		
Insurance (P&I, hull, lay-up)	1.00			1.00		0.50	0.50		0.50	0.50		0.50	0.50
Administrative services	1.00			1.00			1.00			1.00			1.00
Annual permit fee	1.00		1.00		1.00			1.00			1.00		
Annual vessel license fee	1.00		1.00		1.00			1.00			1.00		
Property Tax	1.00		1.00		1.00			1.00			1.00		
Vessel and gear replacement	0.20	0.80		1.00		1.00			1.00			1.00	
Retained by permit holders	1.00			1.00			1.00			1.00			1.00

*Allocation of payments by state for food, maintenance and nets based on November 2012 survey of 21 Washington State permit holders. Other allocations based on authors' judgment and discussions with industry sources.

Table B7, which is calculated based on the assumptions in Tables B-6 and B-7, shows estimated permit holder payments by the states to which payments were made. Note that it is the geographical distribution of these payments among states which drives the geographical distribution of economic impacts of Bristol Bay fishing.

Table B-7

Assumed Permit Holder Payments by State

		AK	WA	OR	CA	Other states
Drift gillnet fishery	**Gross Earnings**	**$62,868,393**	**$50,354,315**	**$5,977,872**	**$5,746,199**	**$9,189,977**
	Food	$2,196,411	$1,237,570	$0	$0	$0
	Fuel, oil, & lubricants	$4,615,528	$0	$0	$0	$0
	Crew shares (excluding skipper)	$11,155,174	$12,480,230	$1,890,512	$1,817,245	$2,906,345
	Maintenance (routine & unexpected	$5,271,758	$1,159,967	$0	$0	$0
	Nets (hanging, repair, and web)	$4,631,865	$1,019,169	$0	$0	$0
	Miscellaneous gear & supplies	$1,820,811	$1,637,000	$0	$0	$0
	Raw fish tax	$3,305,851	$0	$0	$0	$0
	Transportation	$1,907,878	$1,640,285	$248,471	$238,842	$381,983
	Moorage, storage, and haul-out	$2,838,262	$0	$0	$0	$0
	Insurance (P&I, hull, lay-up)	$1,843,971	$2,609,667	$156,253	$150,197	$240,212
	Administrative services	$536,244	$599,941	$90,879	$87,357	$139,712
	Annual permit fee	$448,200	$0	$0	$0	$0
	Annual vessel license fee	$67,377	$0	$0	$0	$0
	Property Tax	$696,336	$0	$0	$0	$0
	Vessel and gear replacement	$339,170	$4,259,471	$0	$0	$0
	Retained by permit holders	$21,193,558	$23,711,015	$3,591,757	$3,452,558	$5,521,725
Set gillnet fishery	**Gross Earnings**	**$20,438,233**	**$5,223,620**	**$1,185,452**	**$1,061,650**	**$3,113,126**
	Food	$526,611	$141,157	$0	$0	$0
	Fuel, oil, & lubricants	$499,151	$0	$0	$0	$0
	Crew shares (excluding skipper)	$4,296,140	$919,351	$355,923	$318,752	$934,692
	Maintenance (routine & unexpected	$1,042,271	$123,400	$0	$0	$0
	Nets (hanging, repair, and web)	$712,693	$84,379	$0	$0	$0
	Miscellaneous gear & supplies	$1,097,188	$422,225	$0	$0	$0
	Raw fish tax	$1,536,135	$0	$0	$0	$0
	Transportation	$307,146	$55,867	$21,628	$19,370	$56,799
	Moorage, storage, and haul-out	$179,964	$0	$0	$0	$0
	Insurance (P&I, hull, lay-up)	$117,572	$47,181	$4,870	$4,362	$12,790
	Administrative services	$126,025	$26,969	$10,441	$9,350	$27,419
	Annual permit fee	$129,150	$0	$0	$0	$0
	Annual vessel license fee	$106,011	$0	$0	$0	$0
	Property Tax	$0	$0	$0	$0	$0
	Vessel and gear replacement	$195,279	$1,355,825	$0	$0	$0
	Retained by permit holders	$9,566,897	$2,047,265	$792,590	$709,816	$2,081,427
Total: drift gillnet and set gillnet fisheries	**Gross Earnings**	**$83,306,625**	**$55,577,935**	**$7,163,324**	**$6,807,849**	**$12,303,103**
	Food	$2,723,023	$1,378,728	$0	$0	$0
	Fuel, oil, & lubricants	$5,114,679	$0	$0	$0	$0
	Crew shares (excluding skipper)	$15,451,313	$13,399,581	$2,246,435	$2,135,997	$3,841,037
	Maintenance (routine & unexpected	$6,314,029	$1,283,367	$0	$0	$0
	Nets (hanging, repair, and web)	$5,344,557	$1,103,548	$0	$0	$0
	Miscellaneous gear & supplies	$2,917,999	$2,059,225	$0	$0	$0
	Raw fish tax	$4,841,985	$0	$0	$0	$0
	Transportation	$2,215,024	$1,696,152	$270,100	$258,211	$438,782
	Moorage, storage, and haul-out	$3,018,226	$0	$0	$0	$0
	Insurance (P&I, hull, lay-up)	$1,961,543	$2,656,848	$161,123	$154,559	$253,002
	Administrative services	$662,268	$626,909	$101,320	$96,708	$167,130
	Annual permit fee	$577,350	$0	$0	$0	$0
	Annual vessel license fee	$173,388	$0	$0	$0	$0
	Property Tax	$696,336	$0	$0	$0	$0
	Vessel and gear replacement	$534,449	$5,615,296	$0	$0	$0
	Retained by permit holders	$30,760,455	$25,758,280	$4,384,347	$4,162,374	$7,603,152

Source: Calculated from Tables B5 and B6.

Appendix C

Estimation of Processor Payments by Industry and State

Almost no data are publically available for Bristol Bay processors' costs or their payments by state, except for payments for labor, taxes and fish. Our other assumptions about processor payments are based almost entirely on discussions with industry sources and our best judgment about processors' average processing costs per pound.

The largest payment by processors is to fishermen to purchase fish. This payment is the ex-vessel value. We omit ex-vessel value from this discussion of processor payments. Our focus is on payments from the increase in value by processors, or total first wholesale value minus ex-vessel value.

Table B-8 shows the increase in value by Bristol Bay salmon processors in 2010, expressed both in dollars and also on a per pound basis. Note that value increase per pound may be expressed either as value increase per round (harvested) pound or as value increase per processed pound. Value increase per processed pound is smaller, because processed volume is smaller than harvested volume, as parts of the fish (heads, guts, etc.) are discarded during processing.

Table B-8

Increase in Value by Bristol Bay Salmon Processors, 2010

	Source or calculation	
Total first wholesale value FOB Bristol Bay	ADG&G COAR database data reported in Table A-12	$389,667,996
Ex-vessel value paid to permit holders	CFEC data reported in Table A-3	$165,158,835
Increase in value by Bristol Bay processors	First wholesale value - Ex-vessel value	$224,509,161
Production volume	ADG&G COAR database data reported in Table A-12	116,718,352
Harvest volume	CFEC data reported in Table A-3	181,226,355
Value increase per processed pound	Value increase/ Production volume	$1.92
Value increase per round (harvested) pound	Value increase / Harvest volume	$1.24

Table B-9 summarizes the assumptions which we used to estimate processor payments. We discussed our assumptions about payments to labor (wage payments to processing workers) in Table A10. For all other payment types, we assumed average total costs (payments) either per round pound or per processed pound, as shown in the table, based on discussions with processors and our best judgment.[5] Similarly, we allocated payments among states based on discussions with processors and our best judgment. Note that we allocated most payments to Washington, where all the large Bristol Bay processors are headquartered, and where most processing supplies and services are purchased.

Table B-9

Assumptions Used to Calculate Estimated Processor Payments in 2010
(expressed in dollars per round or processed pound)

Payment type	Assumptions about total payments		Assumed shares of payments, by state				
	Assumed total payments per round lb	Assumed total payments per processed lb	AK	WA	OR	CA	Other States
Total payments by processors (a)	$1.24	$1.92					
Labor	Estimates derived in Table A-10		Estimates derived in Table A-10				
Tendering	$0.17		20%	70%	10%		
Maintenance		$0.25	10%	90%			
Packaging		$0.20		60%			40%
Fishermen's support services	$0.10		30%	61%	9%		
Variable supplies		$0.09	20%	70%			10%
State & local taxes	$0.06						
Fuel		$0.06	25%	75%			
Utilities		$0.06	100%				
Insurance	$0.03			100%			
Food		$0.04	10%	90%			
Air travel		$0.04	5%	95%			
Fixed supplies		$0.03	10%	80%			10%
Rents & leases		$0.01	100%				
Other payments and returns to investment	Total payments minus other assumed payments		5%	90%			5%

(a) Source: Table B-8.

[5] Note that it is a very difficult task, even for processors, to estimate total costs or costs per pound in processing. Costs per pound vary, sometimes widely, by product, by year, and between processors. Labor costs depend on the timing and volume of the fish run, which affects the extent to which processors need to pay overtime to keep up with the volume of fish that must be processed, or alternatively pay food and housing costs for workers who are not working because there are no fish to be processed. To different extents and in different ways, processors allocate fixed costs between Bristol Bay salmon processing operations and other operations in Alaska and other states. Even where data are available about the costs for particular operations, it is difficult to generalize from these to the costs of the entire industry.

Table B-10 summarizes our assumptions about direct payments generated by Bristol Bay fishing and processing in 2010, based on the data, assumptions and analysis reported earlier in this appendix.

Table B-10

Assumed Direct Payments from Bristol Bay Fishing and Processing, by State, 2010

		State to which payments were made				
	Total	Alaska	Washington	Oregon	California	Other States
Total first wholesale value FOB Bristol Bay (a)	$389,667,996					
Value increase in Bristol Bay by processors (a)	$224,509,160					
Ex-vessel value paid to permit holders (a)	$165,158,836					
Payments by processors (b)	**$224,509,160**	**$43,355,550**	**$142,913,670**	**$6,257,029**	**$12,590,406**	**$19,392,506**
Labor	$33,963,492	$3,905,802	$9,045,069	$1,472,653	$12,590,406	$6,949,563
Tendering	$31,533,386	$6,306,677	$22,073,370	$3,153,339	$0	$0
Maintenance	$29,179,588	$2,917,959	$26,261,629	$0	$0	$0
Packaging	$23,343,670	$0	$14,006,202	$0	$0	$9,337,468
Fishermen's support services	$18,122,636	$5,436,791	$11,054,808	$1,631,037	$0	$0
Variable supplies	$10,504,652	$2,100,930	$7,353,256	$0	$0	$1,050,465
State & local taxes	$9,909,530	$9,909,530	$0	$0	$0	$0
Fuel	$7,409,027	$1,852,257	$5,556,770	$0	$0	$0
Utilities	$7,003,101	$7,003,101	$0	$0	$0	$0
Insurance	$5,436,791	$0	$5,436,791	$0	$0	$0
Food	$4,668,734	$466,873	$4,201,861	$0	$0	$0
Air travel	$4,668,734	$233,437	$4,435,297	$0	$0	$0
Fixed supplies	$3,501,551	$350,155	$2,801,240	$0	$0	$350,155
Rents & leases	$1,167,184	$1,167,184	$0	$0	$0	$0
Other payments and returns to investment	$34,097,086	$1,704,854	$30,687,377	$0	$0	$1,704,854
Payments by permit-holders (c)	**$165,158,836**	**$83,306,625**	**$55,577,935**	**$7,163,324**	**$6,807,849**	**$12,303,103**
Crew shares (excluding skipper)	$37,074,364	$15,451,313	$13,399,581	$2,246,435	$2,135,997	$3,841,037
Maintenance (routine & unexpected)	$7,597,395	$6,314,029	$1,283,367	$0	$0	$0
Nets (hanging, repair, and web)	$6,448,105	$5,344,557	$1,103,548	$0	$0	$0
Vessel and gear replacement (d)	$6,149,746	$534,449	$5,615,296	$0	$0	$0
Insurance (P&I, hull, lay-up)	$5,187,074	$1,961,543	$2,656,848	$161,123	$154,559	$253,002
Fuel, oil, & lubricants	$5,114,679	$5,114,679	$0	$0	$0	$0
Miscellaneous gear & supplies	$4,977,224	$2,917,999	$2,059,225	$0	$0	$0
Transportation	$4,878,269	$2,215,024	$1,696,152	$270,100	$258,211	$438,782
Raw fish tax	$4,841,985	$4,841,985	$0	$0	$0	$0
Food	$4,101,750	$2,723,023	$1,378,728	$0	$0	$0
Moorage, storage, and haul-out	$3,018,226	$3,018,226	$0	$0	$0	$0
Administrative services	$1,654,336	$662,268	$626,909	$101,320	$96,708	$167,130
Property tax	$696,336	$696,336	$0	$0	$0	$0
Annual permit fee	$577,350	$577,350	$0	$0	$0	$0
Annual vessel license fee	$173,388	$173,388	$0	$0	$0	$0
Retained by permit holders (e)	$72,668,608	$30,760,455	$25,758,280	$4,384,347	$4,162,374	$7,603,152

(a) Source: Table B-8; derived from data reported in Tables A-3 and A-12.

(b) Payments from value increase in Bristol Bay by processors (excludes payments to permit holders for fish). Calculated based on assumptions shown in Table B-9. Total payments by state are sums of payments estimated for payment categories.

(c) Payments from ex-vessel value paid to permit holders, from Table B-8.

(d) Assumed to equal depreciation

(e) Returns to permit holders' labor, management and investment

Estimation of Multiplier Economic Impacts of Bristol Bay Salmon Fishing and Processing

As discussed in Appendix D, we used the payment assumptions in Table B-10 as inputs to the national IMPLAN model as well as the state-level IMPLAN models for Alaska, Washington, Oregon and California to estimate multiplier (indirect and induced) economic impacts of Bristol Bay salmon fishing and processing in 2010. Table B-11 shows our resulting economic impact estimates.

Table B-11

Estimated Economic Impacts of Bristol Bay Salmon Fishing and Processing, 2010

Measure	Type of impact	Total US	Alaska	Washington	Oregon	California	Other states
Annual average employment	Direct effect	1,987	728	538	92	357	271
	Indirect effect	2,370	761	1,212	57	4	336
	Induced effect	3,482	578	1,025	106	245	1,529
	Multiplier effect	5,852	1,338	2,237	163	249	1,865
	Total effect	7,839	2,067	2,775	255	606	2,137
Income	Direct effect	$143,706,464	$50,117,570	$48,202,930	$8,103,434	$18,888,777	$18,393,752
	Indirect effect	$111,622,227	$37,988,890	$53,955,158	$2,704,107	$266,830	$16,707,242
	Induced effect	$156,420,295	$23,975,329	$43,666,690	$3,982,928	$11,854,314	$72,941,034
	Multiplier effect	$268,042,522	$61,964,219	$97,621,848	$6,687,035	$12,121,144	$89,648,276
	Total effect	$411,748,986	$112,081,789	$145,824,779	$14,790,469	$31,009,921	$108,042,028
Output value	Direct effect	$389,667,996	$126,662,175	$198,491,605	$13,420,353	$19,398,255	$31,695,609
	Indirect effect	$310,685,906	$88,414,231	$155,525,182	$7,149,132	$742,553	$58,854,809
	Induced effect	$490,516,601	$72,592,909	$132,244,901	$11,707,734	$35,799,082	$238,171,974
	Multiplier effect	$801,202,507	$161,007,140	$287,770,083	$18,856,865	$36,541,636	$297,026,783
	Total effect	$1,190,870,503	$287,669,315	$486,261,688	$32,277,218	$55,939,890	$328,722,392

APPENDIX C:
ESTIMATION OF DOWNSTREAM ECONOMIC IMPACTS OF THE BRISTOL BAY SALMON INDUSTRY

The downstream economic impacts of the Bristol Bay salmon industry are those driven by the transportation, secondary processing, warehousing, distribution and retailing of Bristol Bay salmon which occurs in other states. Table C-1 summarizes our estimates of the volumes of Bristol Bay salmon shipped to other states, the volumes sold in the U.S. domestic market, and selected other assumptions for our downstream economic impact analysis.

Table C-1

Assumed End-Markets for Bristol Bay Salmon Production, 2010

		Frozen	Canned	Fresh	Roe	Total
Millions of pounds	Total production	80.0	29.9	2.9	4.0	116.7
	Exported directly from Bristol Bay	39.8	0.0	0.5	4.0	44.3
	Shipped to other states	**40.2**	**29.9**	**2.4**	**0.0**	**72.4**
	Exported from other states	25.2	26.9	0.2	0.0	52.2
	Sold in US domestic market	**15.0**	**3.0**	**2.2**	**0.0**	**20.2**
Share of production	Total production	100%	100%	100%	100%	100%
	Exported directly from Bristol Bay	50%	0%	19%	100%	38%
	Shipped to other states	**50%**	**100%**	**81%**	**0%**	**62%**
	Exported from other states	31%	90%	6%	0%	45%
	Sold in US domestic market	**19%**	**10%**	**76%**	**0%**	**17%**
Other assumptions	Mode of transportation to other states	Sea	Sea	Air		
	Assumed states to which products were initially shipped	100% to Washington	50% to Washington 50% to Oregon			
	Types of secondary processing, warehousing and labeling prior to distribution to retailers	Filleting, portioning, reboxing, smoking	Warehousing & labeling			

Sources: ADF&G COAR Data; NMFS Fisheries Trade Data, and discussions with industry sources, as discussed in Appendix C.

In this appendix, we discuss our estimation of selected downstream economic impacts associated with transportation, secondary processing and other value adding, and distribution and retailing of Bristol Bay salmon. We organize our discussion as follows:

- Estimation of payments for marine transportation and secondary processing of frozen salmon
- Estimation of payments for marine transportation, warehousing and labeling of canned salmon
- Estimation of payments for distribution and retailing of Bristol Bay salmon products
- Estimation of economic impacts and contributions using IMPLAN models

Estimation of Payments for Marine Transportation and Secondary Processing of Frozen Salmon

Table C-2 documents our estimation of end-markets for Bristol Bay frozen salmon production. We based our estimates on data for total Alaska frozen sockeye production, total Bristol Bay frozen sockeye production, total US exports of frozen sockeye salmon and US exports of frozen sockeye directly from Alaska. Note that no data are available on exports of frozen sockeye salmon specifically from Bristol Bay. We assumed that the share of Bristol Bay frozen sockeye salmon which is exported directly is the same as the share of Alaska frozen sockeye salmon which is exported directly.

Table C-2

Estimation of End-Markets for Bristol Bay Frozen Sockeye Salmon, 2010

		Source	Volume (lbs)
Primary production of frozen sockeye salmon	Total Alaska production	a	113,360,944
	Bristol Bay production	b	79,961,576
	Bristol Bay share		71%
Exports of frozen sockeye salmon	Total US exports	c	92,087,890
	Exports from Alaska	c	56,428,432
	Exports from other states	c	35,659,458
Assumed end markets for total Alaska production	Exported from Alaska	c	56,428,432
	Exported from other states	c	35,659,458
	Consumed in the United States	d	21,273,054
Assumed end markets for Bristol Bay production	Exported from Alaska	e	39,803,007
	Shipped to other states	f	40,158,570
	Exported from other states	e	25,153,164
	Consumed in the United States	e	15,005,406
Assumed end-market shares for Bristol Bay production	Exported from Alaska	g	49.8%
	Shipped to other states	g	50.2%
	Exported from other states	g	31.5%
	Consumed in the United States	g	18.8%
	Share of shipments to other states consumed in the US	h	37.4%

(a) Source: Alaska Department of Fish and Game, Commercial Operator Annual Reports, data provided by ADF&G December 5, 2012.

(b) Source: Alaska Department of Fish and Game, Commercial Operator Annual Reports, data provided by ADF&G August 2, 2011.

(c) National Marine Fisheries Service, Foreign Trade in Fisheries Products website, http://www.st.nmfs.noaa.gov/st1/trade/

(d) Total Alaska production minus total exports

(e) Calculated as Bristol Bay share of total production x assumed end markets for total Alaska production. Assumes that markets for Bristol Bay sockeye salmon are the same, proportionally, as for all Alaska frozen sockeye.

(f) Total Alaska production minus volume exported from Alaska.

(g) Calculated from assumed end market volumes

(h) Volume consumed in the United States / Volume shipped to other states

Table C-3 documents our estimation of expenditures associated with marine transportation of Bristol Bay frozen sockeye salmon in 2010. Key assumptions are that the average cost of shipping frozen salmon to the United States was $.26/lb, and that all frozen salmon not exported directly was shipped to Washington State.

Table C-3

Estimation of Expenditures Associated with Marine Transportation of Bristol Bay Frozen Sockeye Salmon, 2010

Line	Assumption or calculation	Notes	Total	Washington
1	Volume of frozen Bristol Bay salmon shipped to other states (lbs)	a	40,158,570	
2	Average first wholesale price of frozen Bristol Bay salmon (FOB Bristol Bay)	b	$3.23	
3	Value of frozen salmon shipped to other states	c	$129,701,765	
4	Marine transportation cost per pound	d	$0.26	
5	Total expenditures for marine transportation = value increase in marine transportation	e	$10,441,228	
6	Total value after shipping to other states	f	$140,142,993	
7	Average value per pound after shipping	g	$3.49	
8	Assumed allocation of marine transportation expenditures, by state	d	100.0%	100.0%
9	Assumed marine transportation expenditures, by state	h	$10,441,228	$10,441,228

(a) Source: Table C-2; (b) Source: Table A-11; (c) Line 1 x Line 2; (d) Assumed based on discussions with industry sources; (e) Line 1 x Line 4; (f) Line 3 + Line 5; (g) Line 2 + Line 4; (h)

Table C-4 documents our estimation of the increase in value associated with secondary processing of Bristol Bay frozen sockeye salmon in other states. Key assumptions included the relative share of primary product forms produced in Bristol Bay (Line 3), the types of secondary processing in other states (Lines 6 and 7); the increase in value per pound for each type of secondary processing (Line 12), and the share of secondary processing occurring in Washington State (line 14). Note that all of these assumptions were based on discussions with industry sources. We had no independent source of data for these assumptions, and neither did our industry sources, except for their own costs and product allocations. Thus these assumptions should be considered reasonable approximations of the types of secondary processing which occurred and the extent of value added, but not precise estimates.

Table C-4

Estimation of Expenditures Associated with Secondary Processing of Bristol Bay Frozen Sockeye Salmon in Other States

Line	Assumption or calculation	Notes						
1	Total value of frozen Bristol Bay salmon shipped to other states, after shipping	a	$140,142,993					
2	Primary product forms produced in Bristol Bay	b	All	Vaccum-pack fillets	Vacuum-pack portions	IQF fillets	Headed & Gutted	
3	Assumed share of frozen salmon shipped to other states, by primary product form	b	100%	15%	5%	20%	60%	
4	Volume of frozen salmon shipped to the Lower 48 for secondary processing, by primary product form	c	40,158,570	6,023,785	2,007,928	8,031,714	24,095,142	
5	Average value per pound after shipping	a	$3.49	$3.49	$3.49	$3.49	$3.49	
6	Types of secondary processing in other states	b	All	Re-Boxing	Re-Boxing	Portions (includes cutting, reglazing, boxing & bagging)	Fillets (includes thawing, filleting, refreezing)	Smoking
7	Assumed share of secondary processing type, by primary product form	b		100%	100%	100%	90%	10%
8	Volume before secondary processing	d	40,158,570	6,023,785	2,007,928	8,031,714	21,685,628	2,409,514
9	Value before secondary processing	e	$140,142,993	$21,021,449	$7,007,150	$28,028,599	$75,677,216	$8,408,580
10	Assumed secondary processing yield	b		100%	100%	90%	70%	70%
11	Secondary product volume	f	32,126,856	6,023,785	2,007,928	7,228,543	15,179,939	1,686,660
12	Assumed increase in value per pound (secondary product weight basis)	b		$0.25	$0.25	$1.00	$2.10	$5.50
13	Increase in value in secondary processing	g	$50,390,974	$1,505,946	$501,982	$7,228,543	$31,877,873	$9,276,630
14	Assumed share of increase in value which occurs in Washington	b		100.0%	100.0%	100.0%	80.0%	80.0%
21	Estimated increase in value in Washington	i	$42,160,073	$1,505,946	$501,982	$7,228,543	$25,502,298	$7,421,304
26	Value after secondary processing	j	$190,533,966					

(a) Source: Table C-3; (b) Assumed based on discussions with industry sources; (c) Total volume from Table C-2, volume by secondary processing type allocated by shares in line 7; (d) Headed & gutted volume allocated by shares in line 7; (e) Line 5 x Line 11; (f) Line 8 x Line 10; (g) Line 11 x Line 12; (h) 20% non-Washington share allocated to other states in proportion their share of the total 2010 United States population excluding Washington state; (i) Line 13 x Line 14; (j) Line 13 x Lines 16-19.

Note that we only estimated the increase in value associated with secondary processing which occurs nationally and in Washington. Our estimates of downstream economic impacts for Oregon do not include impacts of secondary processing which occurs in Oregon.

Estimation of Payments for Marine Transportation, Warehousing and Labeling of Canned Salmon

All Bristol Bay canned salmon production is shipped to warehouses in Washington and Oregon where it is stored and labeled prior to shipments as sales are made over the course of the year. Table C-5 documents our estimation of payments associated with shipping, warehousing, storing and labeling canned salmon.[6]

Table C-5

Estimated Expenditures of Bristol Bay Processors for Canned Salmon Shipments to Warehouses, Storage, and Labeling, 2010

	Freight south	Handling in	Storage (assumes 5 months)	Labeling	Handling Out	Ink Jetting	All cost categories combined
Rates paid per case*							
Talls	$2.790	$0.169	$0.370	$0.700	$0.180	$0.044	
Halves	$1.500	$0.096	$0.295	$0.700	$0.107	$0.044	
Quarters & Four-Pound	$0.960	$0.048	$0.145	$0.720	$0.054	$0.044	
Total cost ($)**							
Talls	$673,070	$40,770	$89,260	$168,870	$43,424	$10,615	$1,026,009
Halves	$3,177,266	$203,345	$624,862	$1,482,724	$226,645	$93,200	$5,808,043
Quarters & Four-Pound	$124,372	$6,219	$18,785	$93,279	$6,996	$5,700	$255,351
All sizes combined	$3,974,708	$250,334	$732,908	$1,744,874	$277,065	$109,515	$7,089,402
Assumed share of payments by state							
Washington	50%	50%	50%	50%	50%	50%	
Oregon	50%	50%	50%	50%	50%	50%	
Estimated expenditures by state							
Washington	$1,987,354	$125,167	$366,454	$872,437	$138,532	$54,757	$3,544,701
Oregon	$1,987,354	$125,167	$366,454	$872,437	$138,532	$54,757	$3,544,701

Rates paid per case based on discussions with industry sources. **Assumes, based on discussions with processors and other industry sources, that 100% of Bristol Bay canned salmon was shipped to other states, and that 2010 production was 241,244 cases of talls, 2,118,117 cases of halves, and 129,554 cases of quarters and four-pound cans (24-can case basis).

[6] We consider these assumptions relatively reliable. The distribution of canned product by can sizes is based on a reliable industry data source, and the rates paid per case were provided by a Bristol Bay canned salmon processor.

Appendix C

Estimation of Payments for Distribution and Retailing of Bristol Bay Salmon Products

We next discuss, in turn, our assumptions for payments associated with the distribution and retailing in the United States of Bristol Bay frozen salmon, canned salmon, and fresh salmon. As discussed in Appendix D, we use these payment assumptions as inputs to the IMPLAN national model to estimate national economic contributions of retailing and distribution of Bristol Bay salmon products.

We had no data on the costs associated with distribution and retailing or the prices at which products were sold at retail. Costs and prices of Bristol Bay salmon products vary widely depending upon the geographic region, product form, and types of retail or food service outlet. It was far beyond the scope of this project to collect this kind of information.

For this reason, our assumptions about payments for distribution and retailing of Bristol Bay salmon are based upon a single simple assumption: that *distribution and retailing increases the value of Bristol Bay salmon products by 50% over their value after transportation to the United States and initial secondary processing and/or warehousing/labeling.* We consider this a conservative assumption based on retail prices we have observed for Bristol Bay salmon products in many parts of the United States, but it is *not* based on any formal data collection or analysis of sockeye salmon retail prices.[7]

Because they are based on this single simple but conservative assumption, our estimates of economic activity associated with distribution and retailing of Bristol Bay salmon products in the United States should be considered estimates of *what the associated jobs, income and output value would be if the average increase in value were 50%*, rather than estimates of what the jobs, income and output value actually are. Put differently, they may be viewed as a conservative estimate or low estimate of the potential jobs, income and output value associated with US distribution and retailing of Bristol Bay salmon products.

Tables C-6, C-7 and C-8 show how we estimated the increase in value in US distribution and retailing of Bristol Bay frozen, canned and fresh salmon, respectively.

[7] In estimating the total increase in value in 2010 value for all commercial marine fishery products in the United States, the National Marine Fisheries Service (NMFS, 2011) assumed a 62.7% mark-up of fishery inputs in secondary wholesale and processing of edible fishery products, a 33.4% markup of fishery inputs in retail trade from stores, and a 182.4% markup of fishery inputs in retail trade from food service (NMFS, Fisheries of the United States, 2010 (2011, page 79).

Table C-6
Estimation of Increase in Value in United States Distribution and Retailing of Bristol Bay Frozen Sockeye Salmon

Line	Assumption or calculation	Notes	Amount
1	Assumed value of Bristol Bay frozen sockeye salmon after secondary processing	a	$190,533,966
2	Share of secondary production consumed in the United States	b	37.4%
3	Value of secondary production consumed in the United States	c	$71,193,756
4	Assumed % increase in value from secondary wholesale value to retail	d	50.0%
5	Total value increase in distribution and retailing	e	$35,596,878
6	Total value after retail markup	f	$106,790,634

(a) Source: Table C-4; (b) Source: TableC-2; (c) Line 1 x Line 2; (d) Conservative assumption for average total markup percentage from wholesale value after secondary processing to retail value for sockeye products sold in the United States; (e) Line 3 x Line 4; (f) Line 3 + Line 5.

A challenge in estimating US consumption of Bristol Bay canned salmon is that reported United States exports of canned sockeye salmon significantly exceed reported Alaska production of canned sockeye salmon, as shown in Figure C1. We are unable to explain this. Clearly, the United States cannot continuously export more canned sockeye salmon than it produces. Possibly the Alaska production data are under-reported, the US export data are miscoded, or the two data sources calculate volume differently. In any case, the data suggest that most canned Alaska sockeye salmon are probably exported. However, the fact that canned sockeye salmon can readily be found on US retail shelves shows that clearly some canned sockeye salmon is consumed domestically. For the purposes of our analysis, we made the simple assumption that 90% of Bristol Bay canned sockeye salmon is exported, and 10% is consumed domestically (Table C-7).

Figure C-1

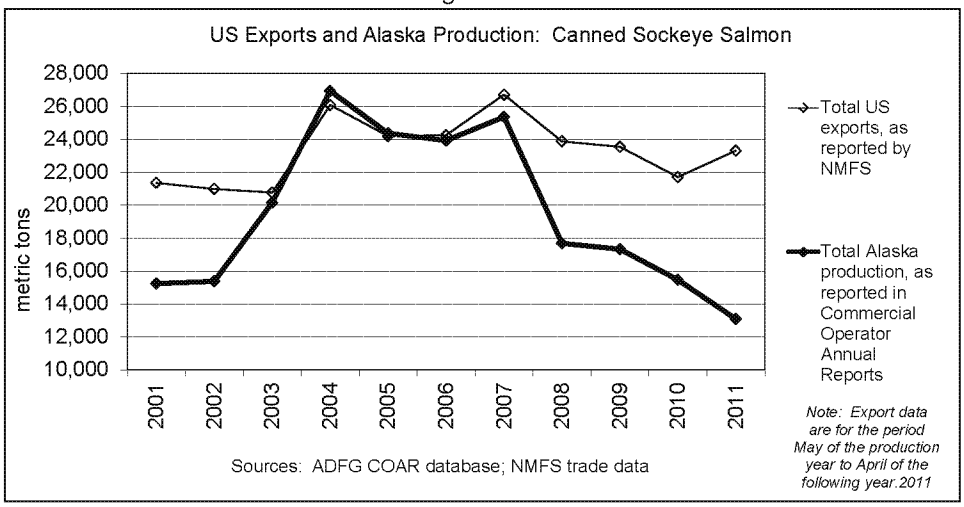

Table C-7

Estimation of Increase in Value in United States Distribution and Retailing of Bristol Bay Canned Sockeye Salmon

Line	Assumption or calculation	Notes	Amount
1	Total first wholesale value of Bristol Bay canned salmon production FOB Bristol Bay	a	$105,376,086
2	Share of Bristol Bay canned salmon shipped to other states	b	100.0%
3	Estimated increase in value in shipping	c	$3,974,708
4	Estimated increase in value in warehousing/labeling	c	$3,114,695
5	Total value after shipping and warehousing/labeling	d	$112,465,488
6	Assumed share sold in the United States	e	10%
7	Total value FOB warehouse of product sold in the United States	f	$11,246,549
8	Assumed increase in value in distribution and retailing (%)	g	50%
9	Assumed increase in value in distribution and retailing ($)	h	$5,623,274
10	Assumed retail value	10	$16,869,823

(a) Source: Table A-12; (b) Assumed based on US trade data and discussions with industry sources; (c) Calculated from Table C-4; (d) Sum of Lines 1, 3 and 4; (e) Assumed: see discussion in text; (f) Line 5 x Line 6. (g) Assumed: see discussion in text; (h) Line 7 x Line 8; (i) Line 7 + Line 9.

C-8 shows how we estimated the increase in value in US distribution and retailing of Bristol Bay fresh salmon. The table includes an assumption that the air freight rate for all Bristol Bay fresh salmon averages $.50/lb. We have no data for average air freight rates, but consider this a reasonable assumption. Alaska Airlines' Seafood Express Rate Sheet (rates and destinations effective September 14, 2011) lists a rate of $.52/lb for 1000-lb shipments from Dillingham and King Salmon (Zone 1C) to Seattle (Zone 4) (http://www.alaskaair.com/~/media/Files/PDF/Cargo/FZ-27-Seafood-Express-201303.pdf). We include this payment for air freight with our assumptions for payments driving the economic contribution of retailing and distribution of Bristol Bay salmon.

Table C-8

Analysis of End-Markets for Bristol Bay Fresh Salmon Production and Estimation of Increase in Value in US Distribution and Retailing of Bristol Bay Fresh Salmon, 2010

		Notes	Volume (lbs)
Fresh sockeye salmon production (lbs)	Total Alaska production	a	17,463,319
	Bristol Bay production	b	2,899,396
	Bristol Bay share of total Alaska production		17%
Bristol Bay fresh salmon first wholesale value & price	Bristol Bay first wholesale value	b	$6,119,811
	Bristol Bay average first wholesale price ($/lb)	b	$2.11
Exports of fresh sockeye salmon (lbs)	Total US exports	c	4,242,182
	Exports from Alaska	c	3,236,734
	Exports from other states	c	1,005,448
Assumed end markets for total Alaska production (lbs)	Exports from Alaska		3,236,734
	Exports from other states		1,005,448
	US domestic consumption	d	13,221,138
Assumed end market shares for Bristol Bay production	Exported from Bristol Bay	e	19%
	Exported from other states	e	6%
	US domestic consumption	e	76%
Assumed end markets for Bristol Bay production (lbs)	Exported from Bristol Bay	f	537,388
	Exported from other states	f	166,932
	US domestic consumption	f	2,195,076
Air freight expenditures	Assumed air freight rate for all Bristol Bay fresh salmon ($/lb)	g	$0.50
	Estimated air freight expenditures		$1,449,698
	Average first wholesale price after air freighting ($/lb)		$2.61
Retail increase in value	Assumed retail markup percentage for US domestic production over Bristol Bay wholesale value and air freight	h	50%
	Assumed retail increase in value for Bristol Bay fresh salmon consumed in the United States	i	$2,865,364

(a) Source: Alaska Department of Fish and Game, Commercial Operator Annual Reports, data provided by ADF&G December 5, 2012.

(b) Source: Alaska Department of Fish and Game, Commercial Operator Annual Reports, data provided by ADF&G August 2, 2011.

(c) National Marine Fisheries Service, Foreign Trade in Fisheries Products website, http://www.st.nmfs.noaa.gov/st1/trade/

(d) Alaska production minus total exports

(e) Assumes the same end market shares for Bristol Bay fresh sockeye are for all Alaska sockeye

(f) Calculated from Bristol Bay production and assumed end market shares

(g) Assumed based on Alaska Airlines Seafood Express Rate Sheet (http://www.alaskaair.com/~/media/Files/PDF/Cargo/FZ-27-Seafood-Express-201303.pdf)

(h) Conservative assumption for average total markup percentage from wholesale value after air-freighting to retail value for sockeye products sold in the United States

(i) 2,195,076 lbs consumed domestically x $2.61 wholesale price x 50% markup.

Estimation of Economic Impacts and Contributions Using IMPLAN Models

Table C-9 summarizes our assumptions of the payments generated by selected "downstream" economic activities in the United States utilizing Bristol Bay salmon in 2010.

Table C-9
Summary of Assumptions for Payments Generated in Selected Bristol Bay Salmon "Downstream" Economic Activities, 2010

	Activity	Source table	United States	Washington	Oregon
Assumptions used to estimate economic impacts of shipping to other states and secondary processing	Marine transportation of frozen salmon	C-3	$10,441,228	$10,441,228	
	Frozen salmon secondary processing	C-4	$50,390,974	$42,160,073	
	Marine transportation of canned salmon	C-5	$3,974,708	$1,987,354	$1,987,354
	Canned salmon warehousing and labeling	C-5	$3,114,695	$1,557,347	$1,557,347
Assumptions used to estimate economic contributions in nationwide distribution and retailing	Distribution & retailing of frozen salmon	C-6	$35,596,878		
	Distribution & retailing of canned salmon	C-7	$5,623,274		
	Air transportation of fresh salmon	C-8	$1,449,698		
	Distribution & retailing of fresh salmon	C-8	$2,865,364		

As discussed in Appendix D, we used the payment assumptions in the top half of Table C-9 as inputs to the national IMPLAN model and the state-level IMPLAN models for Washington and Oregon, to estimate downstream economic impacts of marine transportation of frozen and canned salmon, secondary processing of frozen salmon, and warehousing and labeling of canned salmon. Table C-10 shows our estimates of the combined economic impacts of these activities.

Table C-10
Estimated "Downstream" Economic Impacts of Marine Transportation of Frozen and Canned Salmon, Secondary Processing of Frozen Salmon, and Warehousing and Labeling of Canned Salmon

Measure	Type of impact	Total US	Washington	Oregon
Annual average employment	Direct effect	191	156	15
	Indirect effect	243	103	12
	Induced effect	319	126	12
	Multiplier effect	563	229	24
	Total effect	754	385	39
Income	Direct effect	$13,110,295	$10,968,827	$854,146
	Indirect effect	$15,750,564	$6,340,422	$518,616
	Induced effect	$14,312,471	$5,388,473	$443,453
	Multiplier effect	$30,063,035	$11,728,895	$962,070
	Total effect	$43,173,329	$22,697,723	$1,816,216
Output value	Direct effect	$67,813,775	$56,014,272	$3,513,633
	Indirect effect	$66,205,592	$21,131,321	$1,346,748
	Induced effect	$44,774,640	$16,309,863	$1,302,219
	Multiplier effect	$110,980,232	$37,441,185	$2,648,967
	Total effect	$178,794,007	$93,455,456	$6,162,600

As discussed in Appendix D, we used the payment assumptions in the bottom half of Table C-9 as inputs to the national IMPLAN model to estimate nationwide economic activity associated with distribution and retailing. These estimates are shown in Table C-11.

Table C-11

Estimated Economic Contributions of Distribution and Retailing of Bristol Bay Salmon Products in the United States, 2010

Measure	Type of effect	Activity
Annual average employment	Direct contribution	787
	Indirect contribution	112
	Induced contribution	312
	Multiplier contribution	425
	Total contribution	1,212
Income	Direct contribution	$22,691,854
	Indirect contribution	$5,625,023
	Induced contribution	$14,006,490
	Multiplier contribution	$19,631,513
	Total contribution	$42,323,367
Output value	Direct contribution	$45,535,217
	Indirect contribution	$16,938,512
	Induced contribution	$43,815,952
	Multiplier contribution	$60,754,465
	Total contribution	$106,289,681

Summary of Estimated Direct, Multiplier and Downstream Economic Impacts and Contributions

Tables C-12, C-13 and C-14 on the following page summarize all of the direct, multiplier and downstream economic impacts and contributions we estimated for this study.

Appendix C

Table C-11

Estimated Employment Impacts and Contributions of the Bristol Bay Salmon Industry, 2010 (annual average employment)

Impact driver	Type of impact	Total US	Alaska	Washington	Oregon	California	Other states
Fishing and primary processing in Bristol Bay	Direct impact	1,987	728	538	92	357	271
	Indirect impact	2,370	761	1,212	57	4	336
	Induced impact	3,482	578	1,025	106	245	1,529
	Multiplier impact	5,852	1,338	2,237	163	249	1,865
	Total impact	7,839	2,067	2,775	255	606	2,137
Shipping to other states and secondary processing	Direct impact	191		156	15		
	Indirect impact	243		103	12		
	Induced impact	319		126	12		
	Multiplier impact	563		229	24		
	Total impact	754		385	39		
Nationwide distribution and retailing	Direct contribution	787					
	Indirect contribution	112					
	Induced contribution	312					
	Multiplier contribution	425					
	Total contribution	1,212					
Total impacts and contributions		9,804					

Table C-12

Estimated Income Impacts and Contributions of the Bristol Bay Salmon Industry, 2010 ($)

Impact driver	Type of impact	Total US	Alaska	Washington	Oregon	California	Other states
Fishing and primary processing in Bristol Bay	Direct impact	$143,706,464	$50,117,570	$48,202,930	$8,103,434	$18,888,777	$18,393,752
	Indirect impact	$111,622,227	$37,988,890	$53,955,158	$2,704,107	$266,830	$16,707,242
	Induced impact	$156,420,295	$23,975,329	$43,666,690	$3,982,928	$11,854,314	$72,941,034
	Multiplier impact	$268,042,522	$61,964,219	$97,621,848	$6,687,035	$12,121,144	$89,648,276
	Total impact	$411,748,986	$112,081,789	$145,824,779	$14,790,469	$31,009,921	$108,042,028
Shipping to other states and secondary processing	Direct impact	$13,110,295		$10,968,827	$854,146		
	Indirect impact	$15,750,564		$6,340,422	$518,616		
	Induced impact	$14,312,471		$5,388,473	$443,453		
	Multiplier impact	$30,063,035		$11,728,895	$962,070		
	Total impact	$43,173,329		$22,697,723	$1,816,216		
Nationwide distribution and retailing	Direct contribution	$22,691,854					
	Indirect contribution	$5,625,023					
	Induced contribution	$14,006,490					
	Multiplier contribution	$19,631,513					
	Total contribution	$42,323,367					
Total impacts and contributions		$497,245,682					

Table C-12

Estimated Output Value Impacts and Contributions of the Bristol Bay Salmon Industry, 2010 ($)

Impact driver	Type of impact	Total US	Alaska	Washington	Oregon	California	Other states
Fishing and primary processing in Bristol Bay	Direct impact	$389,667,996	$126,662,175	$198,491,605	$13,420,353	$19,398,255	$31,695,609
	Indirect impact	$310,685,906	$88,414,231	$155,525,182	$7,149,132	$742,553	$58,854,809
	Induced impact	$490,516,601	$72,592,909	$132,244,901	$11,707,734	$35,799,082	$238,171,974
	Multiplier impact	$801,202,507	$161,007,140	$287,770,083	$18,856,865	$36,541,636	$297,026,783
	Total impact	$1,190,870,503	$287,669,315	$486,261,688	$32,277,218	$55,939,890	$328,722,392
Shipping to other states and secondary processing	Direct impact	$67,813,775		$56,014,272	$3,513,633		
	Indirect impact	$66,205,592		$21,131,321	$1,346,748		
	Induced impact	$44,774,640		$16,309,863	$1,302,219		
	Multiplier impact	$110,980,232		$37,441,185	$2,648,967		
	Total impact	$178,794,007		$93,455,456	$6,162,600		
Nationwide distribution and retailing	Direct contribution	$45,535,217					
	Indirect contribution	$16,938,512					
	Induced contribution	$43,815,952					
	Multiplier contribution	$60,754,465					
	Total contribution	$106,289,681					
Total impacts and contributions		$1,475,954,191					

APPENDIX D:
USE OF IMPLAN MODELS FOR ECONOMIC IMPACT ANALYSIS

We estimated economic impacts of the Bristol Bay salmon industry using the IMPLAN impact assessment modeling system. IMPLAN was originally developed by the US Forest Service and is now made available by subscription through MIG, Inc. (http://implan.com/V4/Index.php). It is widely used for economic impact analyses by federal, state, and local governments, universities, and private consultants. At the center of IMPLAN is a set of national, state level and country level input-output models constructed with region specific data derived primarily from government sources including the Bureau of Economic Analysis, the Bureau of Labor Statistics, and the US Census.

Each input output model is a matrix representation of the inter-industry monetary flows within the region (including governments and households). This matrix can be used to estimate the total employment (measured as annual average jobs), income, gross receipts (output value), and value added (output minus the cost of intermediate inputs) generated by the introduction of a new economic activity into a region (or of an activity currently taking place within the region). The model takes as input a set of industry specific expenditures and tracks the flow of those dollars as they are re-spent through the other industries within the region (the multiplier effect). The output of the model is a series of estimates (employment, income, gross receipts, and value added by industry) of the total economic activity in the region attributable to the new activity.

These estimates include both the indirect and the induced effects of the activity. The indirect effect is a measure of effects of the business to business purchases while the induced effect is a measure of effects of purchases by households from income generated by the business expansion.

For this analysis we used the IMPLAN national input output model to estimate the total economic significance of Bristol Bay salmon fishing and processing, as well as downstream activities, for the entire nation.

We used state level models for the four western states—Alaska, Washington, Oregon, and California-- to generate estimates of economic impacts of Bristol Bay salmon fishing and processing in each of these states.[8]

We also used the Washington model to estimate economic impacts of marine transportation, secondary processing of frozen salmon, and canned salmon warehousing and labeling in Washington. Similarly, we

[8] Note that the multiplier (induced and indirect) impacts estimated for the four western states reflect only those driven by the direct effects in each state. For example, the multiplier effects estimated for California are only those resulting from payments made to California households or California businesses, as those payments generate additional payments within California. They exclude those resulting from payments made to Washington households or businesses which generate payments to California households or businesses. Thus, by using state level models, we understate the multiplier effects of Bristol Bay salmon fishing and processing within the four western states. To address this concern, we created a separate model that combined the models for the four western states. This four-state model contained a set of inter-regional trade flow matrices which captured the interstate flow of purchases by an industry in one state from each of the others. However, the difference in estimated multiplier impacts was so small that we only report the estimates based on the state level models.

also used the Oregon model to estimate economic impacts of canned salmon warehousing and labeling in Oregon.

We estimated direct, indirect and induced economic impacts of Bristol Bay salmon fishing and processing for other states as the difference between national economic impacts and estimated economic impacts for each of the four western states.

Allocation of Payments to IMPLAN Industries

The inputs that generate the model results are payments associated with fishing, primary processing, transportation, secondary processing, marine transportation of frozen and canned salmon, air transportation of fresh salmon, secondary processing of frozen salmon, warehousing and labeling of canned salmon, and distribution and retailing of Bristol Bay salmon products. To use the IMPLAN model, we needed to allocate these payments to IMPLAN industry sectors.

Tables D-1 shows our allocations from payment categories to IMPLAN industries for Bristol Bay fishing. Where there was not an obvious match these allocations were necessarily somewhat subjective. Note however that payments to all industries have multiplier effects, and particularly for smaller payments the allocations have relatively little effect on the overall estimated impacts of the Bristol Bay salmon industry.

Table D-1
Allocation of Bristol Bay Fishing Payments to IMPLAN Industries

Fishing payment category	IMPLAN commodity code	IMPLAN Industry
Maintenance (routine & unexpected)	3039	Maintained and repaired nonresidential structures
Nets (hanging, repair, and web)	3085	All other textiles
Fuel, oil, & lubricants	3115	Refined petroleum products
Depreciation (boat building & repair)	3291	Boats
Miscellaneous gear & supplies	3311	Sporting and athletic goods
Food	3324	Retail services-food and beverage
Transportation	3332	Air transportation services
Moorage, storage, and haul-out	3340	Warehousing and storage services
Insurance (P&I, hull, lay-up)	3357	Insurance
Administrative services	3386	Business support services
Raw fish tax	3437	State & local government ,non-education
Annual permit fee	3437	State & local government ,non-education
Annual vessel license fee	3437	State & local government ,non-education
Property tax	3437	State & local government ,non-education

We allocated crew share payments and returns to labor, management and investment to household categories. IMPLAN has nine different income groupings with each of these categories having a distinct spending pattern based on the National Income and Product Accounts (NIPA) and the personal consumption expenditure. We allocated crew share payments to households who earn between 25,000 and 35,000 (sector 10004). We allocated permit holder net earnings to households who earn between 75,000 and 100,000 (sector 10007).

Tables D-2 shows our allocations from payment categories to IMPLAN industries for Bristol Bay primary processing. We allocated processing labor payments to households who earn between 25,000 and 35,000 (sector 10004). We allocated processor profits to households who earn more than 150,000 (sector 10009).

Table D-2

Allocation of Bristol Bay Processing Payments to IMPLAN Industries

Processing payment category	IMPLAN commodity code	IMPLAN Industry
Utilities	3031	Elctricity and distribution services
Maintenance	3039	Maintained and repaired nonresidential structures
Fuel	3115	Refined petroleum services
Food	3324	Retail services-food and beverage
Air travel	3332	Air transportation Services
Tendering	3334	Water transportation Services
Insurance	3357	Insurance
Rents & leases	3365	Commercial and Industrial machinery and equipment rental
Fishermen's support services	3386	Business support services
State & local taxes	3437	State & local government, non education
Fixed supplies	33%: 3149 67%: 3236	Other plastic products & computer terminals Other computer peripheral equipment
Variable supplies	62%: 3014 38%: 3061	Animal products Seafood products
Packaging	88%: 3190 12%: 3142	Metal cans ,boxes,etc & plastics Packaging materials.

Table D-3 shows our allocations of payments from downstream industries to IMPLAN industries.

Table D-3

Allocation from Downtream Industries to IMPLAN Industries

Downstream industry	IMPLAN commodity code	IMPLAN Industry
Marine transportation	3334	Water transportation services
Air transportation	3332	Air transportation services
Frozen salmon secondary processing	50%: 3228 50%: 3142	Material handling equipment Plastics packaging materials and unlaminated films & sheets
Canned salmon warehousing & labeling	50%: 3061 50%: 3389	Seafood products Other suport services
Distribution and retailing of salmon products	3324	Retail services-food and beverage

APPENDIX E:
ESTIMATION OF EXPORT VALUE AND DOMESTIC CONSUMPTION OF BRISTOL BAY SOCKEYE SALMON

Chapter VI includes estimates of the value of Bristol Bay sockeye salmon exports and of domestic consumption of Bristol Bay sockeye salmon.

To develop these estimates, we began by calculating the share of Bristol Bay production in total Alaska production of frozen sockeye salmon, canned sockeye salmon, fresh sockeye salmon and sockeye salmon roe, using ADF&G COAR data. To estimate export volumes and value of Bristol Bay sockeye salmon products, we multiplied these shares by the total US export volumes and values of the corresponding products, as reported in NMFS Fisheries Trade data.

We estimated total US domestic consumption of frozen sockeye salmon as total Alaska production minus total US exports of frozen sockeye salmon, as reported in NMFS Fisheries Trade data. We estimated US domestic consumption of frozen Bristol Bay sockeye salmon by multiplying estimated total US domestic consumption by the Bristol Bay share of Alaska frozen sockeye production.

We estimated the Bristol Bay share of selected US seafood product exports as shown in the Table E-1.

Table E-1

Value of Bristol Bay Sockeye Salmon Exports as a Percentage of Value of Selected US Fish Exports and Import Product Categories, 2010

Export or Import Category	Source	Value	Bristol Bay sockeye export value as a % of value
Total Bristol Bay sockeye salmon exports (estimated)	a	$252,284	
Frozen	a	134,937	
Canned	a	95,702	
Fresh	a	1,728	
Roe	a	19,917	
Total US sockeye salmon exports, all products	b	$341,977	74%
Frozen	b, e	$191,299	71%
Canned	b, e	$109,190	88%
Fresh	b, e	$10,409	17%
Roe	c, e	$31,078	64%
Total US salmon exports, all species and products	d	$898,790	28%
Fresh and frozen salmon	d, e	$591,587	23%
Canned salmon	d, e	$179,424	53%
Salmon roe	d, e	$127,779	16%
Total US edible fish exports, all species	d	$4,379,760	6%
Total US salmon imports (all species and products)	d	$1,755,481	14%
Total US edible fish imports (all species and products)	d	$14,807,678	2%

(a) Estimates in Table E-1. Note: Value is for calendar year exports.
(b) NMFS fisheries trade data reported in Table E-1. Note: Export value shares correspond to shares of Bristol Bay production in total Alaska production.
(c) Sockeye salmon roe production as reported in ADFG COAR data; assumed to be 100% exported.
(d) NMFS, Fisheries of the United States, 2010.
(e) Percentage is % of corresponding Bristol Bay sockeye salmon export product.

APPENDIX F:
COMPARISONS WITH OTHER RECENT ECONOMIC IMPACT ANALYSES OF THE BRISTOL BAY SALMON INDUSTRY

Two recent analyses, listed in the box below, estimated economic impacts of the Bristol Bay salmon industry. We refer to these as the "Goldsmith" and "Schwoerer" analyses.[9]

Both the Goldsmith and Schwoerer analyses were relatively small parts of larger studies, involving other authors, which examined a much wider range of economic topics related to Bristol Bay salmon, including economic impacts of sport and subsistence fisheries and net economic values of Bristol Bay salmon resources. Our discussion here is limited solely to these studies' analyses of economic impacts of the commercial salmon fishery.

Table F-1 (on the following page) compares the employment and income impact estimates of the Goldsmith and Schwoerer analyses with those of this report. For those impacts for which all three studies estimated comparable types of impacts, the estimated economic impacts were fairly close and certainly consistent with each other, given the fact that the analyses were done for three different years.

The major difference between the studies is that *the Goldsmith and Schwoerer analyses estimated only those multiplier impacts which occurred in Alaska.* They did not attempt to estimate the multiplier impacts which occurred in other states. Since the multiplier impacts which occur outside Alaska (the shaded cells in the table) are large—this study estimates they are two to three times as large as those which occur in Alaska—the total economic impacts estimated in the Goldsmith and Schwoerer analyses are much smaller.

The Goldsmith and Schwoerer analyses also did not estimate downstream economic impacts and contributions of the Bristol Bay salmon industry, as was done for this study.

Recent Economic Impact Analyses of the Bristol Bay Salmon Industry

Goldsmith, Scott. 2007. *Economic Significance.* Pages 92-105 of Duffield, J., D. Patterson, and C. Neher, *Economics of Wild Salmon Watersheds: Bristol Bay, Alaska (*Report prepared for Trout Unlimited, Alaska, February 2007).
http://www.bber.umt.edu/pubs/survey/Economics%20of%20Wild%20Salmon%20Ecosystems%20in%20Bristol%20Bay_2007.pdf

Schwoerer, Tobias. *Economic Significance of Healthy Salmon Ecosystems in the Bristol Bay Region.* Pages 171-198 of *Bristol Bay Wild Salmon Ecosystem Baseline Levels of Economic Activity and Values*, in Volume 3, Appendix E of Environmental Protection Agency, *An Assessment of Potential Mining Impacts on Salmon Ecosystems of Bristol Bay, Alaska*, External Review Draft, EPA 910-R-12-004d, May 2012. http://www2.epa.gov/bristolbay.

[9] Dr. Scott Goldsmith is one of the authors of this study, and a colleague of the other authors at the University of Alaska Anchorage Institute of Social and Economic Research (ISER). Tobias Schwoerer is also an ISER colleague of the authors.

Table F-1

Comparison of Selected Recent Economic Impact Analyses of the Bristol Bay Salmon

			Goldsmith	Schwoerer	This report
Type of impact	Year for which impacts were estimated		2005	2009	2010
	Pages reporting economic estimates		98	183	21, 74
Estimated economic impacts of Bristol Bay salmon and processing	Seasonal employment	*Direct impacts*			
		Alaska	4,177	4,341	4,369
		Other states	8,308	7,231	7,552
	Annual average employment	*Direct impacts*			
		Alaska	1,008	707	728
		Other states	1,968	1,190	1,259
		Multiplier impacts			
		Alaska	1,263	1,586	1,338
		Other states			**4,514**
		Total impacts			
		Alaska	2,271	2,293	2,066
		Other states			**5,773**
	Income ($000)	*Direct impacts*			
		Alaska	26,527	40,307	50,118
		Other states	52,693	94,233	93,589
		Multiplier impacts			
		Alaska	41,371	54,705	61,694
		Other states			**206,348**
		Total impacts			
		Alaska	67,797	95,102	112,082
		Other states			**299,667**
Downstream impacts	Total annual average employment				**1,212**
	Total income ($000)				**42,323**

Note: Shaded cells are impacts estimated in this report which were not estimated in the Goldsmith and Schwoerer analyses.

APPENDIX G:
DATA SOURCES FOR THE BRISTOL BAY SALMON INDUSTRY

A rich variety of data exists for the Bristol Bay salmon industry. However, the data can be difficult and confusing to work with, for a number of reasons. Some data are not published, and are available only upon request from Alaska state government agencies. Many data series are available only for limited periods of time: some have been discontinued and are not available for recent years; others have been collected or published only beginning relatively recently and are not available for earlier years. Many data series are inconsistent: reports published by the same agency in different years may provide different data for the same series. Preliminary data (particularly for prices and values) are often revised later, sometimes substantially. Some kinds of data are confidential except when aggregated for minimum threshold numbers of permit holders, processors or other firms. Some kinds of data are proprietary (particularly price data gathered by private market information services). What data mean, how they were collected or estimated, and how reliable they are is often undocumented and unclear. For all these reasons, technical economic analysis of Bristol Bay salmon industry data can be confusing for both the analyst and for the reader.

This appendix describes the major data sources we used for this analysis, and a few other useful sources, in alphabetical order of the names used to refer to them (shown in **bold font**).

ADFG Commercial Operator Annual Report (COAR) Data. In April of every year, all Alaska fish processors are required to submit "Commercial Operator Annual Reports" to the Alaska Department of Fish and Game. In these reports they are required to report the total volume of fish purchased, by species and area; the total amount paid for fish purchased, by species and area; the total volume (weight) of production, by product, species and area; and the total first wholesale value of production. Information about the COAR reporting forms is at:

http://www.adfg.alaska.gov/index.cfm?adfg=fishlicense.coar

The COAR data are not posted on the internet or published regularly by ADF&G (which is unfortunate), but are available by special request from ADF&G. The data used for this report were provided on August 2, 2011 to Gunnar Knapp and were saved as Excel file "Statewide and regional COAR production 1984-2011 provided by ADFG 8-2-11.xls." Average "first wholesale prices" were calculated by dividing first wholesale value by production volume.

ADFG Alaska Commercial Salmon Harvests and Ex-vessel Values Reports. These reports provide summary annual data for each of 11 Alaska salmon harvest areas. The data include average fish weight, average price per pound, numbers of fish, harvest volume in pounds, and estimated value in dollars. Prices for the most recent year are generally preliminary estimates based on fish tickets and reports from area managers. Prices for earlier years are generally based on "Commercial Operators Annual Report and area staff reports." The reports are available at:

http://www.adfg.alaska.gov/index.cfm?adfg=commercialbyfisherysalmon.salmoncatch

ADFG Salmon Ex-Vessel Price Time Series by Species 1984-2011. This is a two-page table of ex-vessel prices by species, 1984-2011, for the following areas: Cook Inlet, Kodiak, Alaska Peninsula, Bristol

Bay, Prince William Sound, Southeast, and Statewide. The original source is cited as the Commercial Operator Annual Reports database.
http://www.adfg.alaska.gov/static/fishing/PDFs/commercial/84-11exvl.pdf

ADLWD Bristol Bay Region Fishing and Seafood Industry Data. The Alaska Department of Labor and Workforce Development (ADLWD) Research and Analysis Division posts a variety of economic information for the Bristol Bay Seafood Industry on its "Bristol Bay Region Fishing and Seafood Industry Data" website at:

http://labor.alaska.gov/research/seafood/seafoodbristol.htm.

ADLWD Bristol Bay Region Fishing Employment Estimates. These are fish harvesting employment estimates posted on the ADLWD Bristol Bay Region Fishing and Seafood Industry Data website as Alaska Department of Labor and Workforce Development, Fish Harvesting Employment by Species and Month, 2001-2011, Bristol Bay Region,
http://laborstats.alaska.gov/seafood/BristolBay/BBAvgMonthlyRegSpc.pdf.

ADLWD Bristol Bay Region Seafood Processing Employment and Earnings Data. These are data for the years 2001-2011 for Bristol Bay region seafood processing total worker count, percent nonresident workers, wages, and percent nonresident wages, posted on the ADLWD Bristol Bay Region Fishing and Seafood Industry Data website as Alaska Department of Labor and Workforce Development, Bristol Bay Region Seafood Industry, 2001-2011, Processing, at:
http://laborstats.alaska.gov/seafood/BristolBay/BBSFPOver.pdf.

ADOR Annual Salmon Price Reports. Every year, "large" Alaska salmon processors (those with sales exceeding 1 million pounds in the previous calendar year) are required to report sales volumes and first wholesale values for major salmon product categories to the Alaska Department of Revenue. Annual statewide summary reports of these data are available on the Alaska Department of Revenue's Tax Division Reports website at:

http://www.tax.alaska.gov//programs/reports.aspx

Once on this page, click on "Alaska Salmon Price/Production." Note that the "Annual Salmon Price Reports" differ from (and sometimes are inconsistent with the "Annual Salmon Production Reports" and "Monthly Salmon Price Reports" which are also available at the same website.

ADOR Monthly Salmon Price Reports. Every four months, large Alaska salmon processors (those with sales exceeding 1 million pounds in the previous calendar year) are required to submit salmon price reports to the Alaska Department of Revenue for the following four-month periods: January-April, May-August , and September-December.
The reports include sales volumes and first wholesale values for major salmon product, by area and month. Summaries of the data from these reports, for each four-month period, are available on the Alaska Department of Revenue's Tax Division Reports website at:

http://www.tax.alaska.gov//programs/reports.aspx.

Once at this page, click on "Alaska Salmon Price/Production." Note that these "Monthly Salmon Price Report" differ from (and sometimes are inconsistent with the "Annual Salmon Price Reports" and the "Annual Salmon Production Reports" which are also available at the same website. Data are not reported for product-area-month combinations for which fewer than three processors reported sales.

CFEC Basic Information Tables. The Commercial Fisheries Entry Commission (CFEC) posts "Basic Information Tables" for each Alaska salmon fishery on its website at:

http://www.cfec.state.ak.us/bit/MNUSALM.htm

These tables provide a useful summary of trends since 1975 in each salmon fishery for numbers of permits issued/renewed, numbers of permits fished, total pounds harvested, average pound harvested, gross earnings, average earnings, and average annual permit prices. The most recent data currently available are for 2010.

CFEC Data for Alaska Salmon Harvests 1980-2005. 1980-2005: CFEC Alaska Salmon Summary Data 1980-2005 061113. These are Commercial Fisheries Entry Commission data for Alaska commercial salmon harvest (number of fish, pounds, earnings, and price), by species, for the years 1980-2005. This file was prepared by the Commercial Fisheries Entry Commission on March 31, 2005, in response to a request by Professor Gunnar Knapp of the University of Alaska Anchorage Institute of Social and Economic Research (ISER). The data was provided as an Excel file named SWPrices.xls, containing the worksheet of this file named "Original data." Professor Knapp maintains a copy of the file named "CFEC_Alaska_Salmon_Summary_Data _1980-2005.xls." The data were calculated from CFEC fish ticket database. The harvest and earnings figures include set and drift gill net, test fishing, confiscated and educational permit harvests, and any other harvest where the product was sold.

CFEC Data for Bristol Bay Salmon Harvests 1975-2003. These are Commercial Fisheries Entry Commission data for Bristol Bay commercial salmon harvests for the years 1975-2003, provided by Kurt Iverson, June 9, 2004, as file BBayEarnHarv1.xls. The data were calculated from CFEC fish ticket database. The harvest and earnings figures include set and drift gill net, test fishing, confiscated and educational permit harvests, and any other harvest where the product was sold.

CFEC Permit and Fishing Activity Data. The Commercial Fisheries Entry Commission (CFEC) posts annual data on permit and fishing activity by year, state, census area and Alaska city on its website at:

http://www.cfec.state.ak.us/fishery_statistics/earnings.htm

For each state, census area and city in which permit holders reside, and for each fishery for which residents held permits, data include the number of permits issued, number of permit holders, number of permits with recorded landings, total pounds landed and estimated gross earnings. Earnings data are confidential for fisheries in which fewer than four permit holders in a census area or community had landings.

FAO FishstatJ Database. FAO FishstatJ is software for fishery statistical time series developed by the Food and Agricultural Organization of the United Nations (FAO) Fisheries and Aquaculture Department, based in Rome. The software is designed to be used with global datasets for capture (wild) fisheries

catches and aquaculture production, by species, country and year. The software and the global datasets can be downloaded from the FAO Fisheries and Aquaculture Department website at:

http://www.fao.org/fishery/statistics/software/fishstatj/en

NMFS Commercial Fishery Landings Database. The National Marine Fisheries Service (NMFS) Office of Science and Technology maintains an online database of US Commercial Fishery Landings (volume and value) by state, species and year. Customized datasets for Alaska and other states may be downloaded from NMFS Commercial Fishery Landings website at:

http://www.st.nmfs.noaa.gov/st1/commercial/index.html

NMFS Foreign Trade in Fisheries Products Data. The National Marine Fisheries Service posts very detailed data online about U.S. exports and imports of fisheries products at:

http://www.st.nmfs.noaa.gov/st1/trade/

The export data in this report were calculated from the "Monthly Trade Data by Product, Country/Association" option at this website.

NMFS Major Ports Data. The National Marine Fisheries Service publishes an annual report entitled *Fisheries of the United States* which provides a wide variety of useful data on United States fisheries. A regular table in this report (on page 7 in recent years), entitled "Commercial Fishery Landings and Value at Major U.S. Ports," lists the value and volume of landings for the top 50 United States ports (ranked by value). The *Fisheries of the United States* reports are available at:

http://www.st.nmfs.noaa.gov/st1/publications.html

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